THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. NOVEMBER 30, 1899. CHICAGO, ILL. NUMBER 48

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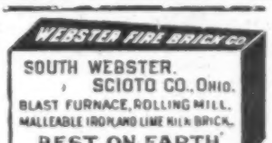
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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. NOVEMBER 30, 1899. CHICAGO, ILL. NUMBER 48

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

At the moment the Lake Superior ore market is a center of interest. Conferences the past week by the selling interests in Cleveland have determined prices for the coming year and in view of the large volume of inquiries pending it is probable that heavy sales will have been made by the end of next week. The base for old-range Bessemer ores—a suppositious ore containing 63 per cent iron, .045 per cent phosphorus and 10 per cent moisture—will be $5.50. A decision has been reached also on the old-range non-Bessemer base—an ore carrying 62 per cent of iron and 12 per cent of moisture—making it $4.15, as against $2 at the opening this year. A significant fact in connection with the basis fixed for old-range Bessemers is that preliminary estimates of next year's production, made by Lake Superior mine managers, show a total less than the output of old-range Bessemer mines this year. It is stated also that the inquiries already in hand for old-range Bessemers are in excess of the estimated production for next year. Sales are announced of Biwabik ore, one of the best Mesabi products, at $4.25, chiefly to connected furnace interests; but other favorite Mesabi ores are held at $5 and $5.25. At $5.50 for standard old-range Bessemer ores, and Mesabis only 25 to 50 cents lower, with coke at $2.75 to $3 at the oven, valley furnacemen figure out a $16 cost for Bessemer iron. It can be appreciated that the market price of Bessemer iron cannot fall far below the $20 line in the next eighteen months without doing injury to the furnaceman who buys ore in the open market. In general, calculations throughout the iron trade are based on a strong market for all of 1900; but all such forecasts leave the furnaceman with his ore purchases for the ore year 1900–1901 but half consumed. There has been little of significance in the market transactions of the past week. Pig iron and steel maintain their strong position, and in Bessemer and foundry iron there is practically a six months' business on the books to-day—a condition that argues no change in prices for some time to come. Production and consumption are coming close to a balance. There is likely to be a period of waiting to get a better idea of the character of the movement in the new year. Significance attaches to continued rail buying, important additions having been made to the large tonnage booked for next year. Export orders of good size have been taken by the Western and Central Western mills. The sheet market continues to be the weakest spot in finished material lines. A movement is reported for a consolidation promoted by the mills themselves without outside aid. The plate market still shows some disturbance in price, chiefly in narrower material which is rolled by groove mills, and these quotations have been used to secure concessions on assorted widths. Meanwhile there is an adjustment of the entire plate market, bringing it into an alignment that was broken some months ago. Bars have been strengthened by the large contracts placed in November, the only irregularities growing out of occasional offerings from second hands. The export trade persists, in the face of all the predictions of its sharp curtailment. A 2,000-ton sale of No. 3 foundry iron for export is reported at $16.50 Birmingham.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
705 PUBLICATION BUILDING, NOV. 29.

The week has brought added strength to the position of raw materials. The price of old range ores has been fixed at $5.50 at lower lake ports, the base ore being close to the analysis of Norrie, as heretofore. It had generally been expected that the price would be between $5 and $5.50, but the general opinion here was that the lower figure was more likely to be chosen. There have been so far about 850,000 tons of Biwabik ore sold, at $4.25 lower lake ports, but as this is relatively lower than the association price on old range ores, the balance of the Mesabi ore will likely go at higher figures. There is considerable difference of opinion as to the outlook in the matter of ore and pig iron. Those in the iron trade have had difficulty enough in attempting to forecast conditions for a sufficient time ahead to determine the business questions which have been coming up with regard to the selling of iron and steel in the first half of next year. The problem now is a much more difficult one, as the buyers of ore have to look 18 months ahead, and to the very best posted it is simply a leap in the dark, but the conditions are such that the leap will have to be made nevertheless.

In the case of ore the question hinges not merely on consumption of and demand for iron and steel, but upon prospective blast furnace capacity and ability to get out ore. There are not wanting men in the ore trade who claim that the output of ore will exceed the smelting capacity, irrespective of demand for the product. It is more easy to judge of the smelting capacity next year than of the ore producing capacity. About the first of the year two new blast furnaces will be blown in at Youngstown. In the course of a few months they will doubtless be up to an output of 600 tons or more a day. Other new furnaces will follow these, but rather slowly. On the other hand, an unusually large number of the furnaces now producing iron are on the ragged edge, and may have to blow out at any moment for relining and other repairs. One of the Eliza furnaces, in this district, has been running on its present lining for seven years, which is easily a world's record. It is as likely that the production in the first half of next year will be less than at the rate of the last three months of this year, as that it will be more. But by the second half we are likely to see an increase in the smelting capacity.

The strength in the cruder forms of production continues unabated. Bessemer pig iron and Bessemer steel are both firmer. There have been some transactions in nearby deliveries in Bessemer, arranged by deferring other deliveries. The large lot of Bessemer which has been under negotiation for over a week is not yet closed, the point at issue being a matter of deliveries. In finished material changes in prices are about a stand-off, most lines being unchanged, while sheets are weaker and steel bars firmer. But the reason for the weakness in sheets is largely because sheet mills have supplies of low-priced sheet bars which they are unable to take unless they sell the product, and they can safely do this at a sacrifice from prices recently ruling. In more than one case the seller of the sheet bars has agreed to extend the deliveries rather than have the sheet market weakened.

PIG IRON.—The most noteworthy feature of the Bessemer market has been the selling of some 15,000 tons of iron for delivery in December and January, the price being $24.60 to $25, Valley furnace. There are other inquiries in the market

for similar deliveries, which may be filled. The iron is secured by arranging for slightly deferring other deliveries, as the furnaces for some time have really had no iron for delivery before say March 1. The inquiry for a large lot of Bessemer, mentioned last week, has not yet been met. The purchaser desires first quarter delivery but would take some third quarter also, while the furnaces now are in worse position to give first quarter iron than before, and are offering second and third quater iron instead. The market is stronger, and it is claimed nothing under $24, Valley, can be done for delivery in the first half. In gray forge and foundry iron the market remains very strong, but rather quiet, with prices unchanged. We quote the market as follows for deliveries after Jan. 1:

Bessemer, valley furnace	$24.00
Bessemer, Pittsburg	24.90
No. 1 Foundry	$23.75 to 24.00
No. 2 Foundry	23.00 to 23.25
No. 3 Foundry	22.25 to 22.50
Gray Forge, valley furnace	20.50 to 21.00
Gray Forge, Pittsburg	21.00 to 21.50

STEEL.—The steel market is still in a rather chaotic condition. There has been considerable selling, amounting to something like half a million tons, but the situation is not clear enough to bring buyers in regularly. There has been a great deal of unwarranted talk about some special transactions in steel a month or two ago, in which only part of the bargains leaked out, and the effect was to produce an unsettled condition, from which the market has not yet fully recovered. Each week however brings added evidence that the market for steel billets will prove to be all that the makers claim for it, and there is no pressure to sell. We quote billets at $36 to $38. For very prompt delivery slightly higher prices than these might have to be paid. Sheet bars are firmer and it is understood are held at a minimum of $38. In wire rods there is practically no market, as the few buyers have contracts extending some time into the future. We quote rods in small lots at $52. In open-hearth steel the situation is a trifle lower, but very firm at present figures. We quote open-hearth steel billets at $45 for delivery early next year.

FERRO-MANGANESE.—There is no change in this line, and we continue to quote $100 for domestic 80 per cent ferro.

RAILS AND TRACK MATERIAL.—The rail market continues quiet. In track material prices are unchanged. While bars are lower than when the present basis was established, it is represented that links and pins, bolts, etc., were lower than they should have been with bars at 2.50c so that no change is looked for in prices. We quote rails and track material as follows: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25 pound, and less than 50 pound, $37, all f. o. b. mill, Pittsburg; track material—Spikes, 2.50c; track bolts, square heads, 3.60c; hexagon heads, 3.85c; splice bars 2.50c to 2.60c; links and pins, 3c to 10c.

BARS.—The market for steel bars is if anything a trifle firmer. The demand is being supplied at 2.25c for steel bars, full half extras, and it is understood that a large order recently went begging at a slightly lower figure than this, which can be done on good sized orders for next year's delivery. Open-hearth steel bars, which had gone up to 3c and even higher, are now held at 2.75c, or $10 above the price of Bessemer, which is about right in comparison with the relative prices of Bessemer and open-hearth steel in the market. We quote all muck iron bars at about the same prices as steel bars. Full half extras, on the new list, are being received in all cases.

STRUCTURAL MATERIAL.—The market for structural material continues good and a large volume of business, considering the time of year, is being done. We quote prices unchanged as follows: Beams and channels, 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees, 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order.

flange 2.70c to 2.80c; and fire box 3¼c to 4c.

PIPES AND TUBES.—There is no change in the market for pipes and tubes. There is considerable inquiry for the first quarter of next year. The demand during November has been very good for the season. We quote prices unchanged as follows: Merchant pipe, 50 and two 10's for car-loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—The plate market is rather quiet, but unchanged as to prices. Skelp sizes continues to be sold at comparatively low figures, but the market in this line is no lower than it was. Prices for prompt delivery are scarcely higher than for the first quarter of next year, except in some cases, where substantial premiums are still required. We quote tank plates under say 50 inches in width at 2.40c; over 50 inches, at 2.50c and very wide plates at 2.60c; shell steel at 2.60c to 2.70c;

SHEETS.—The sheet market is still weaker than at last report. The difficulty is due to the failure of the consolidation movement, and, more important than this, the fact that sheet mills in a number of cases have contracts for bars at low prices, on which they must provide for taking out the tonnage, and are making low prices on sheets in order to do this. It is generally admitted that some of the prices which have been made on sheets would show a loss if the steel had to be bought at present market rates, and this view is confirmed by the fact that the low prices cannot be done for far off deliveries. Some of the sheet mills have been endeavoring to make arrangements to have deliveries deferred on their low priced bars, and have succeeded in some cases, as makers feel that in the present dull condition of the sheet market forcing the sheet manufacturers to take the bars would have a bad effect on the market, and nothing could be gained. We quote No. 28 common sheets, one pass through cold rolls, at 2.95c to 3c, but are advised that lower prices than these have been made in some special cases. On the other hand, a number of sheet mills are quoting higher figures. With the weaker position of spelter, galvanized sheets are lower, and the price of 75 per cent off, with a 15 cent freight allowance, could be easily shaded.

SPELTER—The spelter market is again weaker, the contest between the miners and smelters having forced prices still lower, and we now quote prime western grades at 3c, 4.35c to 4.40c, Pittsburg.

OLD MATERIAL.—The scrap market is quite strong and there is considerable scarcity in some lines. We quote prices as follows, Pittsburg gross tons, except where otherwise specified: New Bessemer melting stock, $26 to $27; basic open-hearth scrap, $28 to $30; steel rails, mixed lengths, $20 to $22; short lengths, $22 to $24; iron rails, $29 to $31; cast borings, $12.50 to $13.50, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $22 to $24, net tons; busheling scrap, $16 to $18, net tons.

COKE.—The coke situation is unchanged. The great bulk of the furnace coke for next year has been sold, while foundries have been rather liberal buyers. We quote strictly Connellsville furnace coke at $2.75 to $3: foundry $3.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Nov. 28.

The aggregate of business last week was not large, and did not include any important buying. Buyers appear to have satisfied their requirements for the immediate future, and producers are not looking for any considerable business to be placed between now and the first of the year. There is considerable demand for material for delivery the last half of next year, but not much business of this character has been placed in the week.

BARS—The demand is mostly for comparatively small lots, although several quite good sized orders were closed in the week. The demands from car works is large and continuous. The market is firm and unchanged at 2.30c to 2.50c, Chicago, half extras for both iron and steel.

PIG IRON.—Immediate demand for iron appears to have been fairly well satisfied, and as a consequence sales are not as large as they were two weeks or more ago. Buying last week was limited to comparatively small lots. Foundries in this district continue to run full time, and are using as much iron as the furnaces can ship to them. Some complaint is heard that furnaces are behind in their shipments, and sellers welcome the slackening up in the demand, as it will give them a little chance to get caught up on their orders. What

buying was done last week was fairly well divided among all classes of iron, both Northern and Southern. The market continues firm, with no changes in prices, although rumors are heard of prospective advances on Southern irons. Quotations are made as follows:

Lake Sup. Charcoal	$25 50@$26 50	Southern Coke No. 3	$20 85@$21 85
Local Coke Fdy. No. 1	24 00@25 00	Southern No. 1 Soft	22 85@23 85
Local Coke Fdy. No. 2	23 50@24 00	Southern No. 2 Soft	21 85@22 85
Local Coke Fdy. No. 3	23 00@23 50	Southern Silveries	26 50@27 00
Local Scotch Fdy. No. 1	24 00@25 00	Jackson Co. Silveries	32 00@32 50
Local Scotch Fdy. No. 2	23 50@24 00	Ohio Strong Softeners	24 50@25 00
Local Scotch Fdy. No. 3	23 00@23 50	Alabama Car Wheel	24 00@26 00
Southern Coke No. 1	22 85@23 85	Malleable Bessemer	23 50@25 00
Southern Coke No. 2	21 85@22 85	Coke Bessemer	25 00@26 00

CAR MATERIAL.—There have been no large orders for cars placed, with the exception of one lot of 1,000 cars, given to a local works. The demand for car material is hardly as large and most wants are satisfied for the present, but shipments to car works on old orders are very large.

STRUCTURAL MATERIAL.—Business last week did not include any important orders. No large contracts are expected between now and the first of the year. Quotations are as follows: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches 2.40c; sheared plates, 2.90c to 3.15c; universal plates, 2.80c to 3c.; tees 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

PLATES.—Quite a little business was done last week, mostly in small lots, although two or three large contracts were closed. The demand is not likely to be large for the next month. Prices are still weak, but no changes are made in quotations. They are as follows: Tank steel from store, 3.10c to 3.25c. Mill shipments, Chicago delivery: Tank steel, 2.90c; shell, 3.10c; flange, 3.25c; marine 3.30c; fire box, 4c to 6c, according to brand.

MERCHANT STEEL.—The demand increased considerably in the week, and the total business done was very satisfactory to the sales agents. Several contracts of considerable size were closed. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—There is no change in the situation. The sales of the week were of fair size, and are likely to continue for some time, as the demand is good. Prices are unchanged at 50 and two 10's off for mill shipment on large orders, and 50 and 10 and 5 off on small orders.

SHEETS.—The situation is still unsettled, with mills not at all strong in many cases. The demand is light for both black and galvanized sheets, and sales have not been large. No. 27 black sheets are quoted at 2.95c to 3.05c, and galvanized at 75 to 75 and 5 per cent off.

BILLETS AND RODS.—Some small sales of rods were made in the week. The local mills are out of the market on billets. We quote Bessemer rods at $55, and open-hearth at $65, Chicago.

RAILS AND TRACK SUPPLIES.—Sales of both light and standard sections have not been large, but the demand is good for small lots, and seems likely to continue so. Quotations are as follows: Rails, standard sections, $35 to $38; light sections, $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.75c to 2.85c; track bolts, 3.65c to 3.85c.

WIRE AND WIRE NAILS.—Sales are hardly likely to increase between now and Jan. 1. Jobbers are practically out of the market, except on small lots, for the present. General trade has been good. Makers quote single carloads of wire nails at $3.25, f. o. b. Chicago, and $3.35 for less than carloads. On wire current quotations are as follows: Plain annealed wire, $3.10; painted barb wire, $3.70; galvanized barb wire, $3.85.

OLD MATERIAL.—The demand is good, especially in small lots, and dealers report an excellent week's business. Prices are very firm, and in some cases those we quote have been lower than actual transactions, but the following fairly represents dealers' selling quotations:

Old iron rails, gross	$32 00@$33 00	Country malleable	$15 00@$16 00
Old steel rails, long, gr.	23 50@24 00	Iron axles, net	32 00@33 00
Old steel rails, mixed	20 00@21 00	Cast borings, net	10 00@11 00
Relaying rails, gross	30 00@31 00	Wrought turnings, net	14 00@14 50
Old wheels, gross	22 00@22 50	Iron axle turnings, net	10 00@10 50
Railroad forge, net	25 00@26 00	Steel axle turnings	15 00
Dealer's forge, net	19 00@21 00	Mixed steel, gross	17 00@19 00
No. 1 cut mill, net	16 00@17 00	Stove plates, net	11 50@12 00
Heavy cast, net	16 00@17 00	Heavy melting steel, gr	20 00@21 00
Railway malleable, net	17 00	Old iron splice b., net	27 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., Nov. 29.

Conferences of ore interests have been held in the past week and the $5.50 base for old-range Bessemers which it has been intimated in this column would be the meeting point between the advocates of $5 and $6 for the base ore, has been finally settled upon. The producers of non-Bessemer ores, who agreed early this year on a minimum of $2 for an ore with 62 per cent iron and 12 per cent moisture, held a meeting on Tuesday and decided that ores which started at $2 this year and soon advanced to $2.50, later to $3, and finally to $4 on late sales of small lots, should sell at the outset for 1900 delivery at $4.15. As noted last week Mesabi non-Bessemers have already sold for $4.25. Other sales of non-Bessemer ore of the new range have been made since at $4.50. At the same time large sales of ore from a leading Bessemer mine on the Mesabi are reported at $4.25, one round lot being taken for Chicago delivery, while the bulk goes to furnace interests connected with the property. These transactions have not led to any precipitate action by other producers of Mesabi Bessemers, and some of the latter whose ores are particularly desirable physically are talking $5 and $5.25. Inquiries from consumers are very heavy and the probabilities are that another week will see the beginning of buying on a large scale. The open weather in the upper and lower lake regions is extending the shipping season, and vessels have left Lake Erie ports in the past few days, taking coal to the head of the lake and expecting to bring ore down. The total of ore shipments promises to exceed all estimates.

PIG IRON.—Local sellers of Northern iron have their estimated production of foundry grades in the first half of 1900 practically disposed of in many instances. Newly started stacks or prospective producers have not been a factor in this market. Prices are quite firm, and while no new period of active buying is looked for in the near future, the opinion prevails that in the Middle West the needs of foundrymen for the first half of next year will be greater than the supply, so far as Northern grades are concerned. The situation as to Bessemer is unchanged. For second quarter delivery $24 at furnace is the market. The basis for steel works metal for the third quarter is not determined, but malleable sales have been at $22 to $23 at furnace. Some Bessemer transactions are reported for the week, chiefly of metal for early shipment, through rearrangement of deliveries with original purchasers. We quote:

Bessemer	$24 00	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@23 50	Valley Scotch No. 2	22 50@23 50
No. 2 Strong Foundry	22 50@23 00	Gray Forge, Valley	21 00
No. 3 Foundry	21 50@22 00	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—There is a quieting down in all lines so far as new orders are concerned, but it need not be said that mill operations are still on the largest attainable scale, excepting only the tin plate works. Some variations in prices appear, and sales from second hands are heard of now and then, indicating that some jobber who stocked up at contract prices ruling early in the year, is evidently more anxious than the mills to get business. With the large tonnages the bar and structural mills have on their books they are not pushing for trade. We note sales of steel bars ranging from 2.40c to 2.50c, Pittsburg, half extras, the smaller sizes carrying lower prices, as the mills rolling lighter material are not so well supplied with work. On ordinary lots of bar iron assorted sizes, 2.25c at mill is still quoted. The light sheet market is quiet, as is expected with winter at hand, and the same is true of galvanized. We quote No. 28 black sheets at 3c, Pittsburg. Sales of plates have been made in the week at 2.70c, Cleveland delivery, for tank, and 2.80c, Cleveland for boiler steel, deliveries in December and January. On deliveries beginning in the new year somewhat lower prices are quoted, particularly on narrow plates, and the desire of certain mills for tonnage has depressed their bids. The new 120 inch mill of the Carnegie Steel Co. has been started in the week and it will be an important factor in the tank plate market. January and February deliveries are now promised on structural material apart from angles, which are less easily obtainable. We quote prices unchanged at 2.25c, Pittsburg, for beams and channels. Some little local business in structural material from store is reported this week.

WIRE AND WIRE NAILS.—There is continued strong demand for plain wire but barb wire is naturally quiet at this season.

In nails there is some variation in prices, some jobbers having stocks bought on a lower basis. To retailers in carload lots the Cleveland basis for smooth wire is $3.05. On wire nails the price to retailers in carload lots, f. o. b., Cleveland, is $3.20; painted barbed wire, $3.75; galvanized, $3.90.

OLD MATERIAL.—The market is only moderately active but prices are substantially unchanged. In the common grades of scrap the supply is more abundant, the collection of such material having had more attention under the attractive prices of the past few months. We quote old iron rails at $30 in the valley; old steel rails, $22, Cleveland; old car wheels, $22; No. 1 railroad wrought scrap, $24 to $25; mill scrap, $17; machinery cast scrap, $11; iron axles, $28; axle turnings, $16; wrought turnings, $13; cast borings, $11.

CINCINNATI.

Nov. 27.

Matthew Addy & Co. say: "There is nothing sensational about the market in this territory. Business is moving along in a steady, regular way that is highly satisfactory. Although the holiday season is approaching yet there is no indication as yet of the usual stupidity of trade that it entails. Probably the most significant event of the week was the sale of 2,000 tons of No. 3 foundry iron for export. This sale was made by the Tennessee Coal, Iron & Railroad Co., and the price obtained was on a parity of $16.50 f. o. b. cars, Birmingham. This is the full current quotation, and if Europe is going to come into the market now for our iron at today's prices, it is the most significant thing that has happened since the advance began. The car situation has not improved in the slightest degree. In the South there is a great scarcity of iron. A trip through the Birmingham district shows that the furance yards there are absolutely bare. The warrant yards, that were once piled high with iron, now look like consumptives in the last stages. They have practically fallen away to nothing. And the condition of the warrant yards has a very important bearing on the market. When the year began there were 200,000 tons of iron in warrant yards. At the present time in Alabama there are less than 9,000 tons in warrant yards all told."

From the current market review of Rogers Brown & Co, we take the following: "There has been a decided struggle through the past week to place orders for certain kinds of iron, even for future delivery. One prominent furnace company had two opportunities from different sources before it, each for 4,000 tons, deliveries to July, 1900. The furnace had but 4,000 tons possible at its disposal for the period. The demand continues liberal and general. Spot iron grows scarcer constantly, and notwithstanding a slight increased production, consumption keeps still in the lead. The Napier furnace has come into the market again, and Cherokee, of Cedartown, Ga., will blow in about Dec. 15, producing charcoal iron. The railroads continue to buy equipment. The car works of this country are figuring today on over 25,000 cars for 1900 delivery, the building of which will require 150,000 tons of pig iron in various forms. The coke situation is as perplexing as can be, the demand exceeding supply. The situation would be easier had railroads adequate rolling stock."

We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge $19.25 to $19.75; No. 1 soft, $21.75 to $22.25; No. 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23 to $23.50; Hanging Rock charcoal, No. 1, $25 to $26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $23.75 to $24.75; Lake Superior charcoal, $25 to $25.50.

PHILADELPHIA.

Nov. 28.

An interval of lighter buying and in a few instances easier prices on some forms of finished material have led buyers to expect a lower level. But in the case of pig iron sellers in general are quite firm. They have so much iron sold ahead that there are practically no offerings, and a quiet time may be looked for for several weeks. Transactions meantime have little or no significance. Smaller consumers have been in the market for lots reaching several hundred tons in some instances, but no large transactions are reported. Furnaces able to spare small amounts of iron from the production in December and January have sold at $23 25 to $23.75 for No. 2X, and as high as $24.25 has been done. Just what the course of the market will be after the first of the year does not fully appear, but there is no pronounced tendency either way at this writing. The increased cost of production that is ahead will hold the lines quite firmly, and if promises of good spring business come early in the year the expectation of easier prices in the first half of 1900 may be disappointed altogether. The cast iron pipe works, ordinarily the largest buyers of coke iron, have not become a factor as yet. Shipments of pig iron are unusually heavy. There is no business of moment in billets. Sellers might accept $38 in firm offers for next year but buyers are disposed to wait, looking for better terms before their requirements must be closed. Muck bar is dull at $31 at maker's mill. Finished material is somewhat easier in plates and sheets, but in other lines prices are well maintained. There are more mills able to make comparatively early deliveries. On contracts for the next three months inside figures can be had. We quote refined bar iron at 2.20c to 2 25c; tank plates, 2.70c to 2.80c; beams, channels and angles, 2.40c to 2.75c; sheets, 3.25c to 3.40c for No. 27. There is a tendency to a softer market in old material, as stocks accumulate, and particularly in the lower grades. Buyers are reducing their bids. We quote choice railroad scrap at $26 to $27; No. 1 yard scrap at $22 to $22.50; machinery cast, $17.50 to $18.50; heavy steel scrap, $22.50 to $24; old iron rails, $29 to $30; old steel rails, $24 to $25; wrought turnings, $15.50 to $16; cast borings, $14 50 to $15; old car wheels, $23 to $24; iron axles, $32 to $33; steel axles, $28 to $31.

Pittsburg Molders' Strike More Serious.

It will be remembered that when the Pittsburg molders and coremakers went to work after the strike in October, the matter was to be decided by arbitration. Late last week the representatives of the founders and their employes came together, and what was thought to be a compromise was arrived at, but when this was done, it was found that while the representatives of the foundrymen had been given full powers, the representatives of the employes had been given no discretionary power at all. This was not in accord with the spirit of the understanding. The proposition finally outlined at the conference was as follows:

"First—That an agreement, the same as entered into in Chicago on May 20, 1899, be made for one year from Nov. 1, 1899, establishing a minimum rate of $2.75 a day for journeymen floor molders.

"Second—That an advance of 5 per cent be made on wages paid Nov. 24, 1899, to journeymen floor molders receiving $2.75 per day or over on that date.

"Third—That such advance be made to take effect as of Oct. 31, 1899, in the foundries of the parties to this arbitration."

This had the sanction of both sides but as the representatives of the employers only had power to act, it was binding only on them. The workers' representatives presented it to a mass meeting on Monday night, and it was received in the light of a proposition from the employers, rather than the result of an arbitration in which both sides were in the same position. The men refused to accept the terms, and decided to have the committee in the various foundries present again the original demand, and thus the whole matter is put back to where it was when the strike began.

Sheet Mill Consolidation.

A meeting of the sheet manufacturers will be held shortly. It is stated that the manufacturers will make an attempt to form a consolidation themselves, without outside assistance.

THE annual meeting of the Allegheny River Improvement Association was held in Pittsburg Monday last. S. B. Cochrane, Kittanning, was elected president, and R. B. McKee, Freeport, secretary. The association's object is to further the slack watering of the Allegheny as far as French Creek. The improvements would be of great benefit to the industrial establishments along the river.

THE WEEK IN IRON AND STEEL STOCKS.

Denison, Prior & Co., in their weekly letter on the iron and steel stocks say: "Monday's market was a distinct disappointment to the bullishly inclined. The heavy increase in reserves in Saturday's bank statement had led to anticipations of an active bull market and in place of that a decidedly heavy affair resulted. Tuesday the tables were turned. The shorts were nipped and it looked as if the powers in control were willing to allow an upward turn in quotations. In the iron and steel list the leaders were Federal Steel and American Hoop common, the latter selling at 48⅜, the highest point it has touched in its market experience. It is said regarding Federal Steel common that Mr. Anson Flower has all of his friends long of it and many of them in at 60 or over. There has been a great deal of bull talk on this particular issue of the Federal Steel Co. in connection with dividends that will be declared after Jan. 1.

"All of the steel companies are reporting large earnings and the stocks are being boomed in consequence. A bull pool is said to be a work in Republic Iron & Steel and great things are promised in a market way. The money market does not, as yet, show material ease and until it does the pools will have a rather hard time maintaining the high quotations for their speculations. We advise caution until there is a marked change in the money situation."

Fluctuations of the Week and the Year.

The following table shows the fluctuations in iron and steel stocks in the week ending with Monday, Nov. 27:

Name.	WEEK.				YEAR.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy.....	17	17	16¾	17	27⅝	May 25	15	June 15
Am. Car & Fdy pr.	62	62¼	62	62	68¾	Sept. 7	56¾	June 16
Am. Steel & Wire..	49	49⅜	47⅞	49	72	May 4	45	Feb. 8
AmSteel & Wire pr	94¾	95½	94¾	95½	106¾	Mar. 13	92⅜	Feb. 8
Am. Steel Hoop.....	45	48¾	44½	47½	48¾	Nov. 27	24	May 24
Am. Steel Hoop pr	83¾	85⅞	82⅛	85	86¾	Sept. 14	70	May 13
Am. Tin Plate.....	35	35	33¾	34¾	52¾	April 4	31⅛	Nov. 10
Am. Tin Plate pr..	83	84	83	84	99⅛	Feb. 8	81	June 8
Col. Fuel & Iron...	53⅛	53¾	52⅛	52⅝	64	Sept. 11	30⅛	Feb. 8
Federal Steel.....	58⅜	62	57⅜	61¾	75	Apr. 3	46⅜	Feb. 8
Federal Steel pr....	81¾	82⅜	80¾	81¾	93¾	April 3	72⅛	May 13
National Steel.....	49	49	46⅜	48	63	April 24	43¾	June 2
National Steel pr..	95	95¼	95	95¼	99⅜	Aug. 11	85	May 15
Pressed Steel Car..	57⅛	59⅜	57	59½	61	Aug. 14	44¾	June 1
PressedSteelCar pr	89¾	89¾	89¾	89½	91	Sept. 7	76	May 25
Republic Steel.....	25⅜	25⅜	24½	2.	33⅜	Sept. 6	22¼	Aug. 26
Republic Steel pr..	71	71	69¾	70½	79	Aug. 29	69	Nov. 6
Tenn. Coal & Iron	115	116⅛	111⅜	115¼	126	Sept 11	36	Jan. 14

Notes.

A statement credited to an officer of the American Steel Hoop Co. say that the net earnings for the fiscal year ending April 1, 1900, on the basis of output sold and raw materials on hand, are estimated at about $5,000,000. The year's dividends on $14,000,000 preferred stock amount to $980,000. The cost of betterments and the interest acquired in the Mahoning mine are put at a million and a portion of this is in defrered payments.

The directors of the Republic Iron & Steel Co. declared a quarterly dividend of 1¾ per cent on Nov. 27, payable Jan. 1.

The published statement of the business of the Tennessee Coal, Iron & Railroad Co. for October shows a net surplus for the month of $125,743, as compared with $19,410 in October, 1898. For the ten months ending with October the net surplus was $815,751 as compared with $164,235 last year.

A Record for Blast Furnace Linings.

The world's record for life of blast furnace lining is held by one of the Eliza furnaces of Laughlin & Co., Pittsburg. This furnace lining is now over seven years old. Another Eliza furnace is running on a lining five years old. This is also a remarkable record.

A CHARTER will soon be secured for the Duquesne Steel Foundry Co., Pittsburg. Among those interested are W. A. Herron, formerly of the Lewis Foundry & Machine Co., Edward Kneeland, of the Frank-Kneeland Machine Co., A. W. Herron, Thomas Rodd, both of Pittsburg, and Thomas H. Bakewell, of New York. A modern steel casting plant will be erected at Coraopolis, a short distance down the Ohio river from Pittsburg.

THE SELLING SIDE OF THE TRADE.

Representatives of Well Known Iron and Steel and Equipment Firms.

Paul S. Pettelle, who became Western representative of the Bement, Miles & Co. last year, with office at 1534 Marquette Bldg., was born in Milwaukee in 1873. He started as office boy with the Ames & Frost Co., in Chicago, in 1876. Later he entered the employ of the Northern Milling Co., controlled by John L. Norton, the pioneer flour miller of Chicago. He

PAUL S. PETTELLE.

began work for Bement, Miles & Co. as an office assistant in 1895, and his promotion came in August, 1898, on the resignation of Charles E. Billin.

L. K. HIRSCH, 549-551 The Rookery, Chicago, has recently brought out a very neat advertising souvenir in the shape of a small pocket calendar and stamp case, bound in celluloid. Mr. Hirsch is a large dealer in scrap iron and steel and old rails and wheels, making a specialty of relaying rails.

SHIPMENTS from Philadelphia will begin this week on the contracts for blast furnace and steel works erection at Sydney, Cape Breton, for the Dominion Iron & Steel Co. The Riter-Conley Mfg. Co., of Pittsburg, has the contract. Shipments by rail have already been made to Montreal of 1,500 to 2,000 tons of iron and steel and other material. For the water deliveries this winter 20 to 25 steamers out of Philadelphia will be needed. From 12,000,000 to 15,000,000 fire brick will be sent via Philadelphia.

THE Roane Iron Co. is about to construct another furnace at Rockwood, Tenn. The mines at Rockwood are sufficient to meet all the demands of the furnace in blast at that point, but would require further development in order to supply two stacks. The company is waiting upon the development of coal mines to the west of Rockwood, and along the line of the Tennessee Central railway, before building a new stack.

The Hastings Engine & Iron Works, of Hasting, Mich., is preparing to enlarge its plant greatly, branching out into the manufacture of registers and water sinks.

THE Big Four Route in rebuilding its freight depot at Cincinnati had to use wood, as steel structural material could not be had soon enough to answer their purpose. The incident illustrates the difficulty still existing in getting steel for prompt shipment.

It is reported that the Midvale Foundry Co., of Allentown, Pa., will build a new plant.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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NOVEMBER 30, 1899.

MESABI RANGE THE BASE OF THE COLUMN.

Now that the measure of the Mesabi range can be more exactly taken, in the light of six years of operation, it is interesting to note that what were once considered wild guesses are really not wide of recent estimates of the Mesabi reserves. Horace V. Winchell, who was one of the first experts on the range, said lately in an interview:

> There is no less than $250,000,000 invested in the iron mining industry in the Lake Superior district. When the Mesabi range was first discovered, miners and merchants of other districts comforted themselves with the vain hope that it was pockety, that its shallow mines would soon be exhausted; that its ores could be used only in small quantities in average mixtures, and so on. But the facts are these: There is more ore in sight today, three or four times over than the whole Lake Superior region has produced in 50 years. Its deposits are deeper, larger, wider and better than those of any other range. For some years past more of its ore has been used than from that of any of the older ranges, and the disparity seems to become greater year by year. Active exploration there dates back but four seasons, and yet there is in sight today nearly 400,000,000 tons of ore, better in quality than the average used in the United States, and perhaps 200,000,000 tons that will average 60 per cent of iron, .06 per cent of phosphorus and 10 per cent of moisture, and the end is not yet. I do not consider it by any means a wild prediction that the Mesabi range alone will produce 500,000,000 tons of iron ore before it is abandoned.

An investigator who recently addressed letters of inquiry to the mining companies on the Mesabi range, got answers with estimates based on actual working and careful exploration. These gave a total of 400,000,000 tons ahead, on the known properties. It is not surprising, in view of the new plane to which the iron industry has risen, that values of Mesabi mines have undergone a radical readjustment in the past year. With shipments in the neighborhood of 6,000,000 tons this year, preparations are making for more than a 7,000,000-ton output next year, or more than all the ranges sent down in a year so recently as 1893. The question of the satisfactory handling of larger percentages of the Mesabi ores is still to be worked out; but there is only one ultimate outcome in that direction. As the production of the old range properties grows less and less, the Mesabi range must make up the deficiency; and with the need of larger percentages of its ores, ways will be found of using them. On the Gogebic range the past season has demonstrated that some properties cannot longer respond to increased demand with increased output. New mines may be found to take the place of the familiar ones that have seen their best days, but the discovery of such successors is yet to be announced. In general the trend of events is toward an increasing dependence upon the Mesabi range for the supply of high grade Bessemer ores. From the present standpoint it is seen that the new Minnesota supply came not a year too soon. Today the announcement of a store so inconceivably large—an announcement that once brought panic and paralysis to the iron mining industry of Lake Superior—is the great steadying and fortifying fact behind the claims for American supremacy in steel.

HARDWARE JOBBERS AND CREDIT REFORM.

We have referred to the reforms as to credits in the iron trade, that have come as a result of prosperity and higher prices. Some of these have come naturally. Sellers have been in position to fix terms, as they have not been for six years past, and buyers' ability to pay promptly has been a welcome relief from the monetary hardships following 1893. Apart from the influence thus exerted by prosperity, the consolidation of iron and steel works has made possible the adoption of regulations difficult to carry out under indiscriminate competition. Leading consolidations have abolished the 2 per cent discount for cash and made terms net cash in 30 days. There was not a little demurring from hardware jobbers when this change was announced; but as the advantages they might derive in turn from enforcing like terms with their own trade were held up, sentiment began to be made favorable to the change. Indeed some of the jobbers recently sent circulars to the retail and consuming trades announcing that with the new year a change would be made in terms to 30 days net. But the opposition to so radical a departure was strong and the makers of sentiment worked industriously, so that at the recent Pittsburg convention of the National Hardware Association the tide seemed to run but one way. The resolutions adopted by the convention took the ground that the discount for cash must not be considered as bank discount, as the manufacturers put it, but as a premium for prompt payment; and the vote was practically unanimous in favor of the retention of the discount where still allowed, and its restoration where it had been abolished. Commenting on this action, *Hardware* says:

> It was very evident to the trade that the abrogation of the 2 per cent cash discount for payment in 10 days would reflect injuriously on all the prompt paying houses in the Association, the manufacturers confessing that there was no possible way within their reach that would prevent letting some of their customers take anywhere from one to three months' additional time, without their ability to enforce a penalty. As the hardware jobbing trade has become virtually a cash paying aggregation of dealers, this was something impossible to stand, and the outcry against it became loud and deep. At the very earliest opportunity in the proceedings of the convention it was grappled with successfully, and a resolution

was unanimously passed by the delegates from the 178 large houses of the country; and upon an appeal being made to the manufacturers present as to their acquiescence in the purport of this resolution, but one dissenting voice was heard. * * * To change arbitrarily the condition of affairs which has existed for so many years it is very evident would work a great hardship upon the jobber, throwing upon his shoulders the burden of collection and of obtaining the facilities for keeping his own credit in the highest state of perfection. It is obvious from the action of the convention that this will be left just as it should be, by which the cash discount is not considered a concession as offsetting bank interest, but as a premium for prompt payment, and will hereafter never be considered as an element of cost, but as a slight working percentage of profit retained by the office that will be found very advantageous in making an interesting balance sheet at the end of the business year.

The argument that the cash discount is a premium on prompt settlements appeals more strongly to the jobber than to the manufacturer. Credit questions are far more disturbing to the former than to the latter, since the circle of buyers is larger and many accounts are with dealers of small means. The manufacturer, on the other hand, could probably sell with perfect confidence to practically every member of the National Hardware Association and could only regard the cash discount as so much taken from his price. After all, the question is one of margins, and the manufacturer may fairly argue that if the jobber desires to continue the discount to his customer, he should make up his price schedule on a basis that will allow this.

UNEASINESS about the export trade in iron and steel began to be felt six months ago, but the statistics still show substantial gains. It is to be presumed that as export contracts made at low prices are filled, the decline will be apparent, and it is probably true that export shipments are not being replaced ton for ton in new orders at high prices. Yet export sales are being made week by week, and one for 30,000 tons of steel rails was included in the business of last week. The October report of the Bureau of Statistics indicates that iron and steel exports for the calendar year will go above $100,000,000, or about $25,000,000 in excess of any other year in our history. The following table shows the value of the principal articles of iron and steel and manufactures thereof exported during the ten months ending Oct. 31, 1899, compared with the corresponding 10 months of 1898:

	Ten months ending Oct. 31	
	1898.	1899.
Machinery, n. e. s.	$12,797,211	$15,393,015
Builders' hardware	5,734,224	7,306,721
Metal working machinery	4,742,488	5,532,864
Pipes and fittings	3,636,047	5,486,333
Wire	3,447,930	4,435,077
Locomotive engines	4,663,849	4,272,850
Sewing machines	2,620,196	3,261,399
Pig iron	2,003,046	2,860,439
Pumps and pumping machinery	1,809,167	2,466,014
Electrical machinery	1,934,474	2,454,510
Typewriters	1,714,328	2,318,011
Structural iron	1,112,778	1,776,617
Steel sheets and plates	622,727	1,609,873
Engines, other than locomotives	1,323,370	1,537,256
Wire nails	462,838	1,185,328
Steel bars or rods	511,164	863,145
Printing presses	662,491	788,087
Cut nails	497,423	580,822
Bar iron	182,913	363,787
Iron sheets and plates	144,201	300,989
Total iron and steel and manufactures	67,299,560	86,162,258

THE account of David McK. Lloyd, receiver of the Spang Steel & Iron Co., which is being wound up, has been presented to court and is to come up for approval Dec. 23.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Pittsburg Foundrymen's Association was held at the headquarters, Frohsinn Building, Pittsburg, Monday evening last. Between 30 and 40 members and visitors were present. The meeting was called to order at 8:30 by the president, Dr. R. G. G. Moldenke. Mr. Sawhill was to have presented a paper on "The Use of Conveyors in the Foundry," but was prevented on account of press of business.

The principal discussion of the evening was on the matter of the conference recently held in Philadelphia, with the object of bringing out closer working relations between the different local bodies. The report of this conference prepared by Secretary John A. Penton, of the American Foundrymen's Association, was read, together with the resolutions adopted at Philadelphia which we printed last week in our report of the conference. The substance of the resolutions, it will be recalled, was a recommendation that the various local associations of foundrymen meet monthly on the same evening and have the same papers for simultaneous discussion.

Quite a full discussion of this subject in all its bearings followed. While the association was quite ready to subscribe to the spirit of all resolutions, it was pointed out that its present quarters, which are very convenient, could be had only on a very limited number of nights, and that the holding of the meetings of all the local associations on the same night might be an awkward matter, if any other than Monday night should become to be chosen. The members were disposed to feel that this possible difficulty was not insurmountable, inasmuch as the holding of the meetings in the same week, though perhaps on different nights, would subserve all the desired ends. There was considerable discussion as to whether it would be desirable to accept more than one paper for a given night. Those who favored the securing of as many papers as possible for each night held that the paper presented by each local organization should be taken as the one of first importance for that particular organization, and should first be read by its author, the discussion following. It was pointed out that the presence of the author always facilitated the discussion, so that by this means each paper would receive a good discussion by at least one of the organizations. The matter was finally left in the hands of Secretary F. H. Zimmers, it being pointed out that the secretary of the American Foundrymen's Association was ready to co-operate by correspondence with the different local bodies in order to arrive at an agreement on all these matters.

Mr. Seaman, president of the American Foundrymen's Association, said that the time approached for selecting the place for holding the next national convention and that both Chicago and Boston had given invitations. He asked that an expression of individual opinion be given in the matter. A rising vote showed that those present favored Boston, mainly for the reasons that the New England district stood in particular need of encouragement and that the West had already been favored in this direction.

Dr. Moldenke mentioned as a fit matter for discussion at some future meeting the whole subject of export business. He referred to some conversation he had just had with a visiting German founder, who was desirous of bringing his foundry up to the efficiency of American foundries. The molders in his foundry did less than a third as much work per day as was done in similar American establishments, but there seemed to be no way in which they could be spurred to do better.

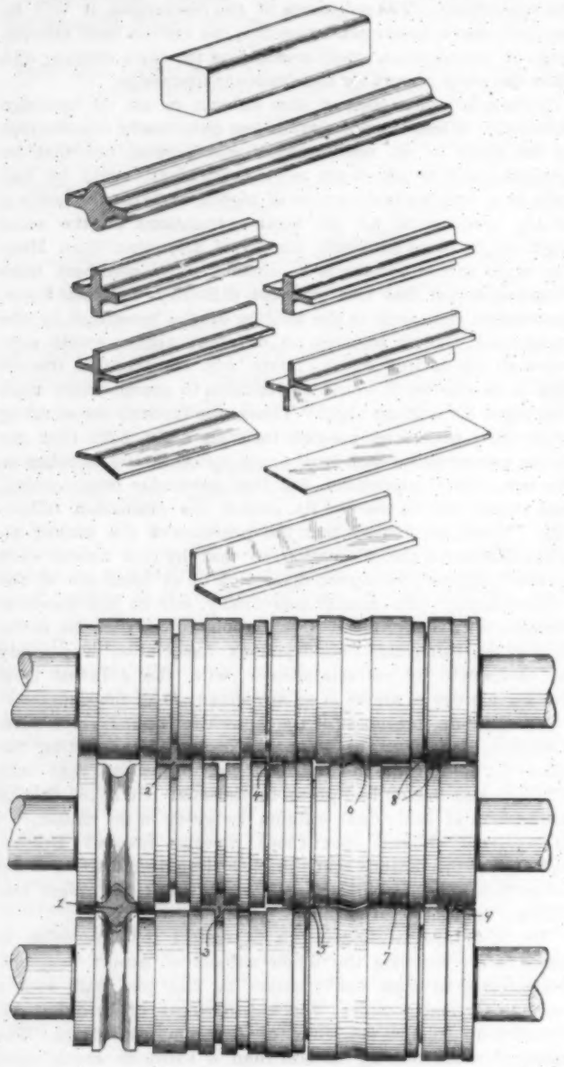
THE Norwood Bicycle Co., of Cincinnati, announces that its plant which burned a short time ago will soon be running again. The insurance adjustment will be made within the next 10 days and the company will then start with full force. A large number of orders have been received for the Norwood company's steel-ball machine crank handles, from machine tool manufacturers thoughout the country.

THE Elliott-Blair Steel Co., of New Castle, Pa., has about completed an addition to its works to increase its annealing capacity, and to give more storage room for raw and finished material, as well as increasing shipping facilities. The improvements were necessitated by the growth of the business.

METHOD OF ROLLING ANGLES AND FLATS.

The accompanying cut explains a new method of rolling angles and flats, on which letters patent No. 636,521 have been issued to Joseph Guest, of Homestead, Pa. The process has not yet been tried, but Mr. Guest is an old and experienced roll turner, and is confident that the principle involved is entirely practicable and will result in a great saving.

The principle employed is that of rolling a star shape from a bloom 6 or 8 inches square. The engravings show the passes and the intermediate sections produced, in projection. At each pass the piece is turned quarter ways, as reduction is only made on the horizontal legs of the star shape. This, it is represented, has an incidental advantage in throwing off whatever scale is produced during the preceding pass. When the star shape has been completed as to two of its legs, it goes through pass No. 4, where the other two legs are reduced to



the proper thickness, and at the same time there is an offsetting action whereby the under face of one leg is brought in the same horizontal plane as the upper face of the other. The section is then in shape to go through pass No. 5, where there is a separation, producing two complete angles. If it is desired to go further, and produce wide flats, pass No. 6 opens out the legs of each angle in turn, pass No. 7 making the perfect flat. If narrow flats are desired, the angles produced in pass No. 5 go in turn direct to pass No. 8, where a separation is made of each angle, into two small flats, which are given a further pass in pass No. 9.

It will thus be seen that with something like the same reduction that occurs ordinarily in producing a single angle, it is aimed to produce two complete angles or two flats, or, if desired, four narrow flats can be produced from the original single section.

PERSONAL.

W. C. Brewer, formerly with the Shelby Steel Tube Co., at Toledo, O., is general manager of the Heckert-Baltzley Billet Co., whose Findlay, O., plant is soon to be started.

President Charles T. Schoen, of the Pressed Steel Car Co., intended to sail for Europe Saturday, but it is now likely that the trip will be delayed until after the holidays. It is expected that arrangements will be made for handling the export business of the company in London, and there are indications already of a good field for steel cars in England and Continental countries. Ultimately a foreign plant will be established.

F. L. Clark, secretary of the American Steel Hoop Co., gave a banquet at the Duquesne Club, Pittsburg, Saturday night to the superintendents of the different mills of the company.

Col. Ivanoff and A. Knapp, representing the Russian Government, have been in Pittsburg negotiating with the Pittsburg Locomotive & Car Works for a number of locomotives for use on the railways the Russian government is building.

Guy S. Rinebolt, of Cleveland, has accepted the position of superintendent of the newly organized Lima Steel Casting Co., at Lima, O.

H. S. Pell, lately superintendent of the Stirling Co.'s boiler works at Barberton, O., has been at Chattanooga and other Southern cities with a view to selecting a location for an engine and boiler works.

Col. Thomas H. Ricket, formerly president of the Schuylkill Haven Rolling Mills, is dead. He was engaged extensively for many years in coal mining and railroad constructing.

John O. Donovan, for 23 years connected with the Carnegie Steel Co., has been appointed manager of the American Steel Casting Co.'s works at Sharon, Pa.

Fred. W. Bauer, who has been in charge of the laboratory of the Warder, Bushnell & Glessner Co.'s Springfield, O., has resigned to become connected with the Star Furnace Co., Jackson, O.

Frank H. Miller, of Miller, Wagner, Fieser & Co., Columbus, O., has been made general manager of the Columbus Iron & Steel Co., which will erect the two Marting furnaces at Columbus, from the equipment of three furnaces recently purchased in the Hocking Valley.

Benedict Crowell, of Crowell & Peck, Cleveland, is in Salt Lake City examining mining properties in various camps in that district.

Henry Prentiss, president of the Prentiss Tool & Supply Co., of New York, was banqueted recently at Cincinnati by a number of manufacturers of machine tools, and was presented with a loving cup.

Fred E. Lee, manager, and A. B. Gardner, assistant manager of the P. D. Beckwith Estate, stove manufcturers at Dowagiac, Mich., were banqueted recently by the business and professional men of that city.

E. J. Barney has tendered his resignation from the presidency of the Barney & Smith Car Co. and will retire Jan. 1.

John S. Kennedy, who has been manager of the Sheridan, Pa., Furnaces, will superintend the Stanhope furnace of the Musconetcong Iron Works, now being remodeled at Stanhope, N. J.

R. P. Douglas, formerly manager of the Eliza Furnaces of Laughlins & Co., Pittsburg, has again taken that position.

Philip Jones, recently of Lisbon, O., has been appointed superintendent of the New Albany, Ind., plant of the Republic Iron & Steel Co.

Augustus Miller, for 33 years general superintendent of the Pottstown Iron Co.'s plant at Pottstown, Pa., has resigned.

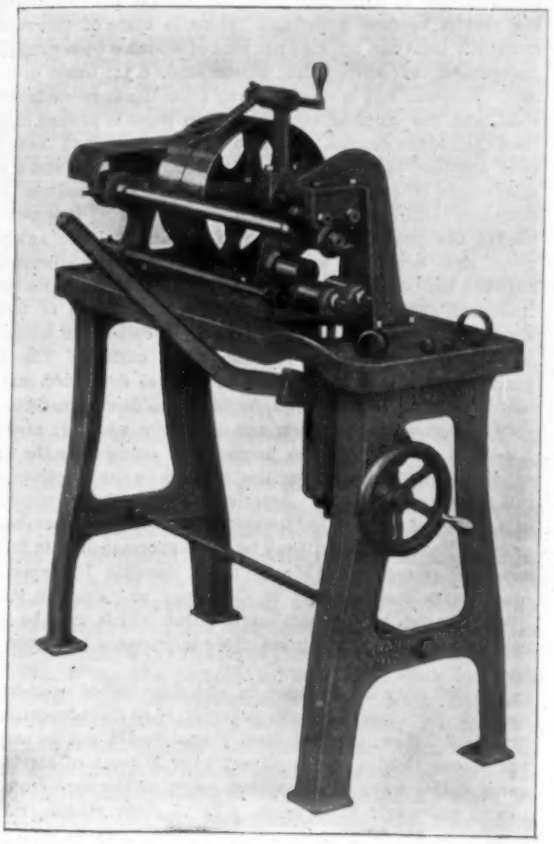
President A. J. Moxham will sever his connection with the Lorain Steel Co., Lorain O., to become general manager of the Dominion Iron & Steel Co. Mention has been made in these columns of the extensive operations which this company has undertaken at Sidney, Nova Scotia, in the erection of blast furnaces, steel works and coke ovens.

Archibald P. Head, of Kensington, Eng., and J. Edward Touch, of Hampstead, Eng., managing directors of the Otis Steel Co., of Cleveland, are now in this country for an examination of the plant. They will visit a number of other works also.

NEW TUBE-CUTTING MACHINE.

In addition to the four styles of tube cutters the Fox Machine Co., of Grand Rapids, Mich., has been making for the market since they were first turned out to cut bicycle tubing for its own business, the company found a demand for a heavy machine, something that would cut tubing as heavy as steam pipe. To fill this requirement it has brought out its No. 5 pipe and tube cutter, retaining the features of the lighter machines adaptable to one of this kind and adding what experience has shown to be desirable, to produce a machine with both quick adjustment and capability to handle heavy work. The capacity of this tool includes heavy tubing, steam or gas pipe, from ⅜-inch to 2½-inch outside diameter.

The lower bearing rolls are of hardened steel, large in diameter and are carried on a heavy plunger. The latter is elevated by a screw adjusted by means of a hand wheel shown at the right. This adjustment is for the different diameters of tubing. The hand lever which operates the cam, raises the bearing roller about ¾-inch sufficient to cut through the wall of the tubing. A piece of steam pipe



NEW TUBE-CUTTING MACHINE.

1-inch in diameter can be cut in ten seconds, a piece 2½ inches in 30 seconds.

The cutting disc is made of fine steel, and on the disc shaft is a hardened sleeve which serves as a bearing. The upper thrust is taken by the anti-friction rollers at the top, distributing the pressure of the cut over a large surface. This makes it durable and capable of standing hard service. The machine is heavily geared. The driving pulleys give back three to one to the cutting shaft, which is ample power for the work required. All gearing is cut from solid steel. An adjustable stop is provided to gauge the length of material and to enable duplicate pieces to be cut quickly and accurately. The weight of the machine is 450 pounds.

The Fox Machine Co. has furnished three of these machines to the Pope Tube Co., who refer to it as leading in the rapidity and effectiveness of its work. An export order has been received from London for six of the machines.

LAKE SUPERIOR IRON MINES.

St. Louis county has what no other county in the United States has and that is four iron mines that can, and probably will, each ship in round numbers 1,000,000 tons of ore next year. These four mines will probably ship not far from two-fifths of the output of the Minnesota iron mines for 1899. The four mines referred to are the Fayal, Adams, Mountain Iron and Mahoning. The first two mines are underground properties and the last two open pits, worked exclusively by steam shovel. The Fayal, however, presents a combination of system. While it is generally called an underground mine, and was exclusively such up to about a year ago, it has also an open cut and the milling system has been installed. There is another mine in St. Louis county that might be depended upon to produce a million tons in a season if demands should be made upon it to that extent, and that property is the Oliver and Lone Jack.—[Eveleth, Minn., Star.

Referring to the operations at Lake Superior properties producing in 1899 for the first time in a number of years *Iron Ore*, of Ishpeming, Mich., says: "In the old ranges there will be few new mines to add to the list which have sent out ore this year. Of the old properties, the East New York, at Ishpeming, the Riverside, near Republic, the Starwest, near Palmer, the Dexter, near Ishpeming, the Michigamme, at Michigamme, will be the only ones. On the Menominee range there will be a few additions, probably, and we know of none on the Gogebic which are not working. Were it not for the Mesabi range there would now be an ore famine in the United States, and the time is not far distant when other ranges will have to be found to keep pace with the consumption." Of the prominent shippers on the Marquette range the same paper says: "The Cleveland-Cliffs Co. will have something over 1,000,000 tons to its credit at the close of navigation for this season's business, this being the largest yearly output in its history. This has been somewhat assisted by the old stockpile at the Clevland Hematite mine, the last of which has been nearly removed. The stockpile lay untouched from the time the property was abandoned up to last year when something like a third of it was shipped. The Lake Superior will excel its fine record of last year with more than 600,000 tons. The Lake Angeline will about equal its record for 1898 (460 000 tons), and will not be 50 tons wide of the estimate made last fall by the superintendent. The Queen will do considerably better than a year ago despite its late start. The Champion will send out about 250,000 tons, considerably better than it did last year. The gain from the Marquette district will be a substantial one over the fine record of 1898."

The total shipment from the Vermillion and Mesabi ranges will be between 7,900,000 and 8,000,000 tons for 1899.

The Minnesota Iron Co. is reported to have closed the purchase of the mineral lands of the C. N. Nelson Lumber Co., on which it has had an option for some time. The lands include the fee of the Auburn mine, near Virginia, some good lands south of the Fayal and Cloquet mines, and other locations. Auburn is under lease to the Minnesota company, having been taken along with other Nelson lands in 1893 on a $400,000 bonus and a 30c lease.

The Oliver Mining Co. is reported to have secured a one-half interest in the Rouchleau property in 17, 58, 17 on the Mesabi range. The remainder is owned by the Lake Superior Consolidated Iron Mines. The Carnegie-Oliver party bought what is known as the Higgins-Gilbert interest.

The Duluth & Iron Range Road has won its suit against the State of Minnesota over its land grant of 600,000 acres, which the State wished forfeited. Half of this had been patented to the road, and the remaining 300,000 acres bein in the courts. The road won every contention.

The Cleveland-Cliffs Iron Co. is reported to have bought the Webster iron mine in Baraga county, two miles west of Michigamme, Mich.

Two of the largest pumping plants in iron mines are to be installed at the Penobscot mine, Mesabi range, and the Loretto, Menominee range. The Penobscot plant will be capable of raising 5,000 gallons of water 200 feet every minute, and will have a duty of 120,000,000 foot pounds. It will include a Wickes vertical water tube boiler and two Prescott cross compound, condensing, crank and fly-wheel engines, of 750 h. p. The Loretto engine will also be a Prescott, and replace a large Cornish pump.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

Purified Open-Hearth Steel vs. Crucible Steel. [*Stahl und Eisen*, Sept. 15 and 30.]—Mr. O. Thallner, of the Bismarkhuette in Upper Silesia, throws some light upon the often discussed question whether open-hearth steel can successfully replace crucible steel. The experiment has been tried often enough, and any quantity of it is regularly sold as cast crucible steel in the market to-day, but it cannot approach in quality the fine grades of crucible steel' as we know the open-hearth steel is now often remelted in crucibles and there can be no objection to calling the product crucible steel, for it is not so much the purity of the material going in (for open-heart steel may be exceptionally so), but it is the process itself which counts so heavily in favor of the product of the crucible. So that after all any steel melted in crucibles, irrespective of the charge is a true crucible steel so long as it serves the particular purpose it is intended for in every way. It is of course important to know whether the material you are buying is really a crucible steel, for this runs into money. Chemical and physical tests are not sufficient to distinguish open-hearth from crucible steel, and really the only guarantee is the maker's reputation. Looking at the details of the processes, we find that to make tool steel out of open-hearth material would require a very pure raw material to begin with, then comes the removal of a considerable portion of the ingot head to avoid pipe, etc., finally a comparatively expensive equipment of machinery to finish the product as the market requires it. So far both processes are nearly equal in cost, but after this comes the loss through bad ingots or "off" heats which rob the open-hearth process of all the advantages secured by its greater output. The consequence is that in making the thousand and one items in tool steel from open-hearth heats the cost will be found no smaller than would have been the case with the regular crucible steel process. The work cut out for themselves by our crucible steel manufacturers is primarily the production of the highest grades of steel, and incidentally the purification of materials in the crucible process which may be as cheap as this process can stand it.

Now in practice much steel is made in the crucible that does not get into tempered tools, but from which the highest grade of strength and homogeneity is required. Here the crucible process is eminently the right one to employ. On the other hand many tools can be made of ordinary Bessemer steel, if desired, though it will be noticed that they are not the hard or hardened varieties, nearly all in fact being used in the annealed state. Where crucible steel is made for this softer variety of tools, Bessemer and open-hearth scrap will answer very well in the charges. In satisfying the requirements of the consumer, both as to quality and composition of the steel, it will be found advantageous to pay particular attention to the make-up of the charge. The remelting of open-hearth steel in the crucible is more closely allied to the Siemens-Martin or Bessemer process than it is to the regulation crucible steel process, for it is really intended to be a method of producing large quantities of a uniform material in small units. The process itself is really only a purification of the steel from slag, and not the synthesis of iron, carbon, manganese, etc., as carried out in making good tool steel from wrought iron with admixtures. Naturally the crucible furnaces are very large, 60 to 120 pots of 70-90 bls. each, and the melted metal is collected in a ladle and cast into ingots in the usual way. In making crucible tool steel, not only is it essential to use the very best raw materials, but to observe every little detail and precaution in the operation which years of experience have taught the practicable melter.

Mr. Thallner now goes into the history of crucibles steel making, tracing it from the old remelted hearth refining steel, the Swedish steel processes, to the modern well-known process. In England there is still in existence the coke-fired crucible furnace, a process which is just dying out in Germany and Austria. The English use clay crucibles, the Germans graphite. The coke-fired furnace, which limits the time for "killing" the heat to the burning of the last charge of coke, or 20 to 40 minutes, prevents the absorption of materials from the crucible walls to a great extent, but the reduction of the oxides is not complete, and hence the ingots are very honey-combed. As a consequence English ingots are subjected to a welding process which restores the density of the metal to a great extent. The composition of the clay crucibles used in England runs about as follows: kaolin, 8; fire clay, 8; pottery clay, 4; coke dust, 2. The metal produced is well represented by the universally known "Huntsman steel," in which carbon runs .96 to 1.31; manganese, .14; silicon, .05 to .10; phosphorus, .012; sulphur, .003, and copper .011 per cent. A steel of this kind is very hard to get free from blow holes. Now follows a list of steel analyses made from well known English brands. They run from .78 to 1.48 carbon; .24 ta .50 manganese; .04 to .25 silicon; .010 to .040 phosphorus; .014 to .035 sulphur, and .020 to .033 copper.

A foot-note calls attention to several of these analyses of "crucible" tool steels as identical with the ordinary Swedish "Bessemer" varieties. The English varieties of tool steel containing chromium, etc., run about as follows (Kayser-Ellison steel): Carbon, 1.03 to 1.49; manganese, 0.30 to 0.46; silicon, 0.13 to 0.19; phosphorus, .013 to .018; sulphur, traces; copper, .010 to .018; tungsten, .13 to .38, and chromium, .34 to .41. In using a graphite crucible to melt Swedish bar we run into difficulties in going above .8 per cent carbon, for too much carbon is absorbed from the walls of the crucible and the results become uncertain. Here is some of this ruined material: total carbon, 1.44 per cent of which 0.69 is graphite; manganese, .21; silicon, .16; silicic acid, 0.34; oxide of iron, .095. Sulphur has a way of going from the crucible into the steel, and the sulphur contents of an ingot is always higher than that of the charge. Thus a charge contained .0187 per cent sulphur 35 minutes after melting, an hour and a half afterwards it contained .0214 per cent. Mr. Thallner now discusses blister steel, which, though, interesting is somewhat behind the present practice in this country. The analyses given are, however, very interesting, as they distinguish between the two forms of combined carbon, no graphite being traceable. The very coarsely crystalline pieces of blister steel ran 1.42 to 1.48 in total combined carbon, of which .82 was carbide and .60 to .66 hardening carbon. The fine-grained specimens ran 1.31 to 1.51 total combined carbon, with .63 to .76 carbide and .68 to .75 hardening carbon. A very fine grained specimen ran similarly 1.01, .47 and .54. Attention is called to the necessity of using only the finest grade of puddled iron for the charges in the crucibles, and this is well known also in America. Where the requirements of a tool steel are not too severe a good grade of open-hearth or even Bessemer steel may be used successfully; in fact, is now used extensively. Much of the Swedish Bessemer and open-hearth steel is sold in Germany as "English steel." Especially the basic open-hearth steel, which may be made nearly chemically pure, gives close approaches to a good tool steel.

The difficulty experienced in utilizing melted open-hearth steel in the crucible is the uncertainty of its composition at that time. Now, for tool steel there should not be such an uncertainty, and a series of analyses is given of steels prepared in this way. The carbons vary all the way from 0.55 to 1.39 per cent; manganese, 0.25 to 0.66; silicon, 0.12 to 0.54; phosphorus, .014 to .033; sulphur, .015 to .044. The variation is too great to give satisfactory results. In order to get some idea regarding the value of a tool steel it is necessary to know the chemical composition and the raw material used. The characteristic of more importance sometimes than the composition is, however, often lost sight of, and that is the molecular constitution. That is to say, steels of the same composition when used for the same purpose often show entirely different peculiarities. Again, a steel with a composition which would indicate inferiority for a certain purpose actually gives better results than another which corresponds exactly to the chemical requirements of the case. These characteristics, well known in practice, are always attributed to the material in the charge.

As a result of thousands of tests and observations the following is given by Mr. Thallmer: First, a certain impulse tending to the formation of certain sized and shaped crystalline groups seems to be present in all the stages of the steel making process; second, a given state of conditions due to heat and mechanical treatment once produced in a steel will not remain thus if that treatment is continued—this is really

the fatigue of a metal. The impulse above mentioned, influenced by the molecular condition, will depend upon the chemical composition, the effect of heating and cooling treatments, and the physical characteristics of the raw material used. This impulse is affected only by heat and mechanical treatment when applied below the melting temperature, and then only with exhibitions of fatigue. This fatigue depends upon the degree and length of application of the heat or mechanical treatment, or both, and upon the number of treatments of this kind received in succession. To look at this closer we find, for instance, that the effects of carbon, manganese, sulphur, silicon, tungsten, chromium, nickel, etc., will be distinctly noticeable throughout the whole process, the fractures show it and even indicate the probable amounts. The melting temperature and duration of the melt have their decided influence on the result, though the effect of the carbon oxide, nitrogen, hydrogen, oxygen, silica, iron oxide, present as admixtures is not yet fully known. That the characteristics of the raw material are transplanted into the finished product is claimed by Mr. Thallner on the principle that charcoal iron gives different results from coke iron, a theory which is fast losing ground, however, in spite of the claims made for the more expensive raw material. The fatigue of the steel produced by continued heat or mechanical effects is noticeable in the reduction of its strength only when the chemical composition has been disturbed, though its resistance to shock is affected considerably in any case. When heat and mechanical treatment is combined on a piece of steel, as for instance in forging, the effects of each may be cumulative at certain periods, and the result is a combination of forging strains, which means a very heavy reduction in the resistance to stress. Even the constant remelting of a steel fatigues it and soon makes it rotten. The addition of ferro-manganese counteracts this, and should therefore always be used. It will be seen that from the number of precautions to be taken in producing the highest grade of tool steel the use of processes aiming at great tonnage are too uncertain in their results to give the satisfaction desired.

Casting Block-Tin Tubes.

Of the inventive ingenuity of Eli Whitney, the famous inventor of the cotton gin, Professor Silliman, in some reminiscences published in 1846, cites several interesting examples. In the summer of 1808, for instance, he tells, Whitney was applied to for tubes of block tin, for the purpose of drawing through an innocuous metal the soda water, highly charged with carbonic acid gas, which was then just beginning to be known. Lead and copper tubes were rejected on account of their poisonous properties, and there were then no facilities in the United States for constructing the tubes that were desired. Whitney accomplished the object with his usual precision. The tubes were required to be many feet long, and strong enough to resist a heavy pressure. He caused a mold to be constructed of cast brass, in two parts, each containing, for about two feet in length, one-half of the cylindrical cavity corresponding to the desired tube. When the parts of the mold were accurately fitted and screwed together, they contained the entire cylindrical cavity between them, and to secure the duct through the tube a polished steel rod, of the proper size, and made very slightly tapering, was fixed in the center and the melted metal was cast around it; the rod, being terminated by a ring, was easily knocked out. The separate parts of the tube, thus produced, were then joined into one, by having the contiguous ends of two of them brought longitudinally into contact, and included in another mold, containing an enlarged cavity, into which melted tin was poured. The duct was preserved by a steel rod passing through it as before, and thus the joint was perfected by a knob of metal which at once united the two tubes into one, and gave them great additional strength. Whitney did not state that this method was original, but up to that time there had, as far as is known, been no similar method of casting block tin tubes.—[Cassier's Magazine.

THE gas and gasoline engine manufacturers of the country at a recent meeting in Chicago discussed the trade situation. About 20 firms were represented. Higher prices are being realized.

AMERICAN TOOL MAKERS' TRIUMPHS ABROAD.

The *American Machinist* is disposed to draw the line between engineers who have gained their knowledge from books and from a study of the work of others, and the practical men who do things, in the bestowal of credit for the favor American machinery is winning in foreign markets. We make an extract from its editorial on the subject in which it seeks to differentiate between academic and practical engineering:

It would, we think, pay some of those who are discussing, more or less pompously, the question of American competition with British machinery builders and what the meaning and purport of this competition may be, if they would sit down and calmly consider what particular work it is that has been and is now doing most to enable us to win our way in foreign markets. We have no desire to disparage the work of any class of men, but it is ridiculous to see American writers, who are almost purely academic engineers, nonchalantly assuming that it is the work of the class of engineers which they themselves represent that is winning laurels (and dollars) for us abroad, whereas it is really the work of a class of men often sneered at as "practical men" that is doing most of this.

In the nature of the case no very accurate comparisons can be made, but who is there that can compare foreign with American academic engineering and say that ours is so much better than that which is found abroad as to account for our recent triumphs? Who is there that will say that our engineering is, on the whole, one whit better than is to be found abroad? Particular lines can be mentioned in which, perhaps, it is superior; but to offset these there are lines in which they are ahead of us, and the one particular thing in which we are concededly in advance is in our shop practice and in our shop devices, these being for the most part the work of men who would not think of calling themselves engineers, and who, along with their work, are almost entirely outside the ken of the academic engineers, and are even sometimes despised by them. In many cases where our purely engineering work has taken a position in advance of that of other countries it has been simply because our better shop practice has permitted or made practicable features of design that would have been utterly inadmissible with less advanced shop practice, or with the shop practice of any other country.

An ingenious American—a man perhaps wearing overalls or a denim apron, and having a far more intimate acquaintance with lathe-tools, files and chisels than with moduli of elasticity or radii of gyration, invents an improvement pertaining more or less strictly to his work, or perhaps devises a machine which does away with hand work or quadruples its efficiency—in other words, does what is constantly being done in American shops all over the land. If the machine or device itself is sold, his work becomes known more or less outside the shop in which he works; otherwise not. Afterward an academic engineer, who could not tell a good file from a poor one, applies mathematics and formulas and moduli and other things to this device or machine and tells the world all about how it works and why it works, and lo! the result of his labors on the machine goes into the literature of the profession as engineering work, while that of the creator of the machine is entirely obscured and lost sight of. What we want specially to call attention to is the fact that it is the creative work that is being done mostly in shops by men who are not generally recognized as engineers at all that is, more than any other work, spreading our name and fame abroad; and particularly does this apply to the machine-tool trade.

We would not detract from the credit due to any one, but seek merely to call attention to the plain fact that credit is not being given in some quarters to the men whose work is most clearly and indisputably superior to the work with which it comes into contact abroad. It is this work, in our opinion, that is doing most to advance our foreign trade, and it is essentially the art of the American tool maker; many of the systems of manufacturing now in use here and regarded as entirely new, being in fact nothing more than the adaptations of methods that have been in use in the manufacture of small arms, sewing machines, etc., for many years.

It is a fact that practically no instruction in the tool maker's art is given in schools, and that most of the teachers in those schools hardly know what is meant by the term tool maker; yet, we repeat, it is the work of the tool maker more than that of any other class of men that has placed us in our pre-eminent position as a machinery using, making and exporting nation.

AMERICAN COMPETITION WITH ENGLAND.*

BY ARCHIBALD P. HEAD, OF LONDON.

For many years Englishmen have been accustomed to the importation from America of machinery of a more or less small and delicate nature, but only in the last two or three years have they felt any competition in the home and foreign markets, in heavy iron and steel products, such as pig iron, rails, locomotives and bridges. They are awaking to the fact that a new and powerful rival has sprung up. Whether this is to be a transitory or permanent state of things is the anxious inquiry of many.

The commercial and manufacturing supremacy of England may be roughly assumed to date from the close of the Napoleonic wars, when the industrial progress consequent on the invention of the steam engine, began to develop. It began to sensibly decline during the period following the Franco-Prussian war, when continental nations were at liberty to turn their attentions to the arts of peace. During this period, say 60 years, England came to regard herself as the permanent and natural workshop of the world. For the last 20 years she has been gradually realizing that Continental nations and America have made rapid strides, and cannot only largely supply their own needs, but can compete with her in neutral markets. Unfortunately it has become almost an axiom among Englishmen that home-made goods are of superior quality. Nor is this confined to England, for in foreign countries also "English make" is synonymous with "best make." As competition in iron, steel and machinery, hitherto considered by England her special products, threatens her chiefly from the United States, it is well that she should examine the strong and the weak points of her rival.

The advantages which the Americans enjoy may be summed up under two heads, viz.: natural and sociological. Under the former may be included her marvellous natural resources, especially in iron ore and coal, these two forming the basis of the iron and steel trades, which themselves are the backbone of material progress. The bounties of Nature may be seen to advantage in the Lake Superior ore districts, where rich iron ore is shoveled from an open cutting direct into cars, as if from a natural stock pile; in the Connellsville coal region, where coking coal of a quality equal to Durham is mined in abundance; in the Pocahontas coal field, where steam coal equal to Welsh is mined in self-drained seams, thick enough to admit a locomotive to the working face; in the Birmingham (Alabama) district, where from the top of the Ensley blast furnaces may be seen at once the iron ore mines, the coal mines, and the coke ovens.

Under the head of sociological advantages may be classed (a) the conditions of labor, and (b) the character of the people.

(a). The Conditions of the Laborer. It is difficult for one who has not been in America, and who naturally fancies it is a country inhabited by Americans, to realize the heterogeneous character of the population. It comprises all European nationalities, some of whom have had time to assimilate littlle or nothing of the spirit of the country of their adoption, beyond, perhaps, claiming the rights of citizenship. Thus in one works it is common to find English, Swedes, Germans, Poles, Russians, Hungairans, and Italians working side by side. The cord of sysmpathy between such unions is too slender to admit of effective combination or united action, and the condition of things exists which would be the dream of an English works manager, where each man gets his market value as the result of private treaty. Untrammelled by the more aggressive forms of trade unionism, the best ability of the skilled artisan has free play. He works hard, he uses his head as well as his hands, and welcomes rather than shuns labor-saving appliances, knowing that by such means he can increase his own wealth. The natural law of the survival of the fittest is unchecked. His English cousin, although unsurpassed in skill, is hampered by the artificial restrictions of new trades unionism, and becomes disheartened by the knowledge that the union rules tend to prevent the recognition of merit by reducing all to a dead level. The human nature of an American and an English artisan is much alike, but the conditions of labor are more favorable to the former.

The Yale Lock as an Illustration.

(b). The Character of the People.—It is generally conceded that the average American is more ingenious in shaping means to ends than an average European. This feeling is echoed in such phrases as "Yankee 'cuteness" and "Yankee dodges." The American approaches a problem from a new standpoint, and taking a bird's eye view of the case—unhampered by previous traditions—improves on previous methods on most industries which he takes up. One instance will suffice, that of locks and keys. Europe has been accustomed for centuries to consider a key as comprising two essential parts, the wards for operating the lock, and a distance piece for penetrating the thickness of the door from the outside, where the key is inserted, to the inside where the lock is attached. When the Americans gave their attention to this subject, they soon saw that the distance-piece could be dispensed with and the key made more portable by bringing the locking mechanism of the lock in samll compass to the front of the door, while retaining the bolt at the back. Lock manufacture has developed along these lines in America, and the result is an exquisite piece of mechanism, such as a Yale lock, with its portable key.

The question naturally suggests itself, Whence comes this American ingenuity? It probably arises partly from the newness of the country, and partly from the composite character of the nation. The larger portion of America has only comparatively recently been reclaimed from Nature and the Indians. The gradual process of reclamation and settlement has taxed to the utmost the resourcefulness and resolution of the white man over a period of about 250 years. The stern law of the survival of the fittest has had free play, and has not been restricted in its operation as is the case in older countries. This could not fail to produce a hardy, self-reliant and ingenius race. The same process is going on in British colonies today, and the colonials of the future may be expected to possess many characteristics now seen in Americans. When the United States representatives at the Diamond Jubilee were introduced to the colonial premiers, they exclaimed, "Why, they are more like Americans than British."

Immigration into the United States, which, since the introduction of steam navigation, has reached enormous proportions, might be expected to dilute and weaken the more desirable national characteristics of ingenuity and self-reliance. This, however, is found not to be the case. Firstly, because although it is the poor rather than the comfortable classes of the European countries which emigrate, an emigrant is probably possessed of some enterprise and resolution in order to take such a drastic step, and, therefore, forms a desirable addition to the nation.

Secondly, because history seems to point to the fact that a nation composed of a blend of other races has more vitality than a homogeneous one. The Anglo-Saxon himself is a blend of several distinct nationalities. The Anglo-Saxon nucleus of the American nation has continued the blending process, and with beneficial results. In England, few fresh additions on a large scale have been made since the Norman Conquest, and the increasing homogeneity may tend in time to weaken the vitality of the nation. Other instances, especially among Latin races, might be quoted, of the ill-effects of homogeneity, while the benefits derived from the introduction of "fresh blood" is seen not only in nations, but in families and institutions.

If, then, it be conceded that ingenuity and the mechanical instinct is more widespread in America than in England, it becomes easy to understand how the Americans, hampered by dear labor and great distances, have succeeded in utilizing their ingenuity to overcome them. As a result, labor-saving appliances, and the systematic management of factories, have reached such perfection that while the cost of labor per day is still higher than in England, the labor per ton, or per article, is in many industries lower. The American's motto is, "Labor is dear, capital is cheap," and accordingly he spends large capital sums on machinery to reduce labor, and finds it a very paying investment.

Instances might be multiplied of labor-saving appliances

* Extract from an article in London *Engineering*. Mr. Head is managing director of the Otis Steel Co., Ltd., of Cleveland, O.

in all departments of industry, but it will suffice to mention a few of those connected with the iron and steel industry. At every stage labor is reduced to a minimum. The loading of the ore from the mines into cars, its passage through the loading docks into lake ore vessels, its removal therefrom into cars or stock piles at the receiving ports, the unloading from cars at the smelting plant, the charging into the blast furnaces, the casting of the metal into pig iron, are all performed by mechanical means, labor being reduced to a few skilled men to look after the machienry. There is a boldness and directness of purpose characterizing American inventiveness, and the same spirit will cause machinery to be thrown on the scrap heap when anything better is invented. Steel works managers sometimes say that their works should be rebuilt every ten years. In melancholy contrast to this is the tenacity with which some old-established firms in England cling to antiquated machinery on the plea that it still does good work. They ignore the fact that though actually a good machine, it may be relatively a bad one, and that to purchase a new one would be a splendid investment.

The geographical difficulty of great distance has been met by an unrivaled system of inexpensive and efficient railways. Cheapness of construction has been attained by the adoption of bogie rolling stock; by the absence of stringent regulations as to signals, stations, fencing, etc.; and by the cheapness of land and the simplicity of the legislation for its compulsory purchase. Working expenses are kept down by the use of powerful locomotives, large cars with low tare, and long hauls of heavy trains. The result is that goods can be carried in many cases at one-sixth of a penny per ton-mile, which is very much lower than the usual rate in England. The American system encourages competitive railways, while the English system discourages them. The former system works for the benefit of the public, and the detriment of the railway companies, while in the latter system the reverse obtains. In England the ordinary shares of many railways stand at 180 per cent, while industries are being forced to the seaboard or are leaving the country. In America railways replace roads, and are the pioneers of civilization. They are more frequently made with an ulterior object, such as to open up new territory and add value to real estate; if this is achieved then possibly non-success as a carrying company is of minor importance.

Low-Priced American Pig Iron.

One startling result of American competition may be mentioned. Middlesbrough has long been considered the natural world's center of pig iron manufacture, owing to the close proximity of Cleveland ore, Durham coke and limestone, and an excellent seaport. In normal times, indeed, as late as October, 1898, pig iron could be made in Pittsburg, at a cost of 20s per ton less than at Middlesbrough, Eng., in spite of the fact that ore had to be carried nearly 1,100 miles, and coke 50 miles to the furnaces. Before the present activity in trade began, American pig iron, billets, and rails were in successful competition with the British article in England; when trade resumes its normal condition, doubtless the competition will be renewed with increased vigor. From recent indications, it seems not improbable that what has always been considered a specially British industry—the building of ocean ships—will be attacked from America. The raw materials, plates, angles, etc., will be there obtained more cheaply, and, as before, the dearness of labor will be more than neutralized by labor-saving appliances.

The Americans are as bold and ingenious in finance as in mechanics, and as the former is the vital force of engineering, it tells in their favor in international competition The gigantic "trusts" which have recently been formed in many American industries eclipse everything previously done, being different in kind as well as degree from the old-fashioned "combine," or working agreement between competing concerns. The "trust" is an out-and-out purchase by a new company of a number of separate works, which thereafter lose their individuality. Such trusts are sound to the extent that they use their immense power to cheapen construction by economy in management, and the avoidance of wasteful competition. They are unsound to the extent that they attempt to corner the market and stifle competition. They are more stable than the old "combine," since disintegration in falling times is impossible. Rather would the older and less efficient plants of the trust be stopped, and establishment charges thereby reduced. England will probably have to look to still keener competition in normal times from the existence of the trusts, which to all appearances are being worked on a sound and economical basis.

The question naturally arises, What can be done to regain England's old position in the industrial world? The English people will probably never do that, and will have to be content with a share of the world's commerce. But much can doubtless be done to prevent further retrogression, whether relative or actual. The conservatism of Englishmen must be broken down, and they must be content to learn from their American cousins. It is half the battle to realize one's weakness. Happily this state of things is coming about, and a few startling contracts, such as the Atbara Bridge, and the Midland Railway locomotives have brought it home to many Englishmen that American competition is no bogey. There is a decided tendency for English works managers to travel in the United States, and to adopt what is best in American practice, which is a most hopeful sign. The militant element of trade unionism which received a salutary check in 1896, is not dead, and will probably be heard of again. The masters, however, have learned their strength, and if in time a state of things can be attained where an artisan's wages are proportionate to services rendered without restriction to freedom of contract, one of England's greatest disabilities in competing with America will have been removed. If to this be added England's existing advantages of a central position on the highways of commerce, a stable government, a sound financial system, and last but not least, prestige, the prospect of Englishmen holding their own in friendly rivalry with their American cousins cannot be considered other than hopeful.

Tin Plate Wage Conference.

At the usual bi-monthlyexamination of prices and shipments of tin plate, held in Chicago last week to determine wages for the two months, it was found that no advance was in order. The scale requires that an advance of 2 per cent in Amalgamated wages shall be paid for each 10 cents that the average price of shipments exceeds $4.25 for 100-pound coke plates, the average for two months fixing the basis for the next two months. While the present market price of plates is $4.65, such a quantity of shipments at former contract prices was made during September and October that the average did not reach $4.35.

In connection with the conference, the Amalgamated Association, represented by President T. J. Shaffer, brought before the American Tin Plate Co. the matter of a number of tin mills being shut down. The company officials pointed out that this is usually the dull season, and that under the present organization there is not the incentive to take orders at a sacrifice, as was formerly the case with the individual manufacturers, in order to keep the mills running The company fixes the prices, and will be in position to make the plate as it is actually required during the months of heavy consumption. At this time last year buyers were expecting higher prices, and ordered ahead, so that the dull period was not felt so much. Now there is no great prospect of prices going higher. Besides, the company has more mills than ever before, the big 30-mill at New Castle in particular being one that was never operated at all until it passed into the control of the American Tin Plate Co. President Shaffer submitted several propositions by which the work might be distributed among a greater number of men, so as to give some work to all. The company promised to go over the matter carefully and do whatever it could to divide up the work. One of the propositions made by the workers' representative was that the mills be put on four turns instead of three, thus giving the men six hours work instead of eight, and affording employment to one-third more men.

A PAMPHLET of 75 pages and 25 chapters, being the story of the "Ironville Hardware Association," has been published by the David Williams Co., of New York. It is a history of a local association of retail hardware merchants, and of their efforts to eliminate the evils of unreasonable competition and to maintain fraternal relations.

SLOW-SPEED BELT DRIVEN GENERATOR.

When the available space to be devoted to an electrical installation is not limited, the belt driven type rather than the direct connected type is usually adopted. The illustration shows the 260 k. w. size of this line of generators as manufactured by the Fort Wayne Electric Works, Fort Wayne, Ind.

The field poles are composed of wrought iron laminations cast in place in the frame by a method that insures large contact surface and a perfect magnetic circuit, and holds them rigidly in place. These generators are so designed that any change in load within the capacity of the machine does not necessitate shifting of the brushes to prevent sparking at the commutator.

The iron clad armatures have cores constructed of laminated sheet iron with ventilating ducts that permit a free circulation of air through them, preventing excessive heating even when operated on a considerable overload. They are

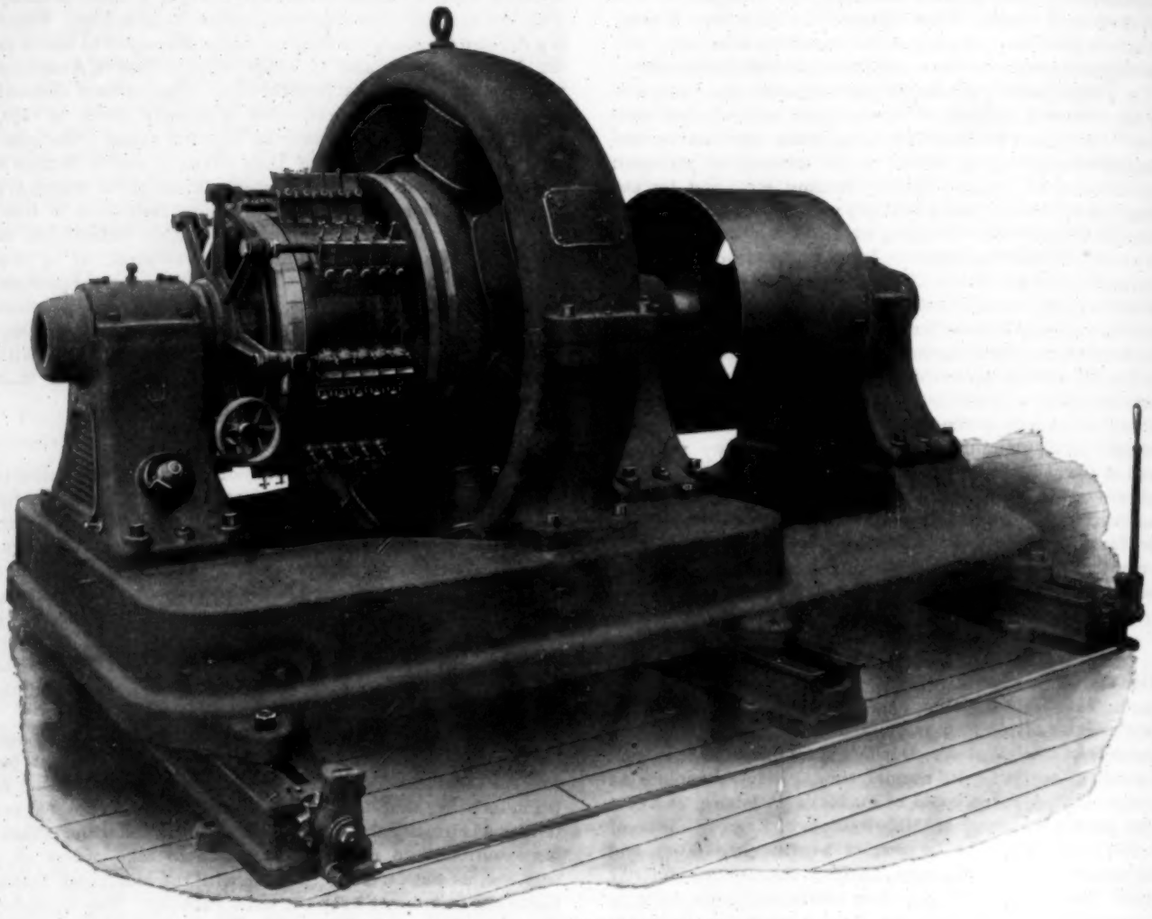


FIG. 1.—BELT DRIVEN, 260 K. W. 500 R. P. M.

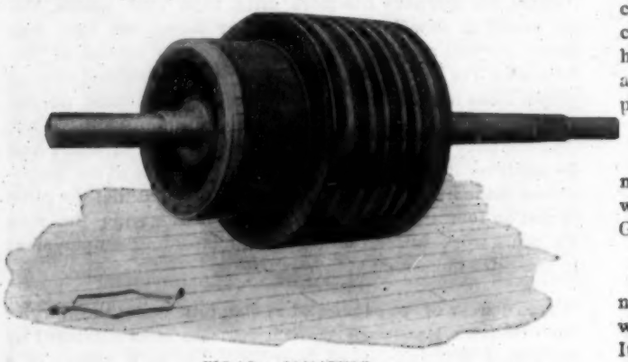


FIG. 2.—ARMATURE.

barrel wound with formed coils placed in slots in the periphery, securely held in place by binding wires.

The commutators are constructed from copper and the segments spaced with mica of corresponding hardness, insuring a smooth wearing surface. The yoke mechanism and brush-holders are of rigid design and substantial. The shifting of the brushes is accomplished by the turning of a small hand wheel. The self-oiling and self-aligning bearings are large and equipped with oil level gauges.

For the 260 k. w. generator shown 390 h. p. is required. Revolutions, 500; diameter of pulley, 40 inches; width of belt, 34 inches; floor space, 103⅛ inches parallel to shaft, by 96¾ inches; total height, 83⅛ inches; weight of armature, 4 675 lbs.; weight of dynamo complete, 18,300 lbs.

CAPT. T. G. BUSH, president of the Alabama Consolidated Coal & Iron Co., made the following statement recently: "The indications are that the present demand for iron will continue through 1900 at least, and that prices will not go any lower than they now are. It is a fact that the furnace companies of the country have sold practically all their production for six months in advance and in face of this a decline could hardly be expected. The pig iron production of the country has greatly increased during the present year, but it has done so without the building of a single new furnace in all the Southern States. I do not look for an advance in the price of pig iron. It is high enough now."

WE are in receipt of the proceedings of the fifth annual meeting of the Lake Superior Mining Institute held at Ironwood, Mich., in August, 1898, with excursions to various Gogebic range properties.

THE Black Diamond Emery Wheel Co. has started in business at 16 and 18 South Canal st., Chicago, occupying the whole of the fourth floor of the building at those numbers. It will manufacture all kinds of emery, corundum and emery-corundum wheels, supplies, etc. The plant is equipped with the latest improved machinery for the manufacture of such products. The business of the company has been very large and it is already considering an enlargement of the plant.

PUNCH AND SHEAR FOR PLATE WORK.

A hand power punch and a shear, also operated by hand power, are shown in accompanying cuts, as manufactured by the New Doty Mfg. Co., of Janesville, Wis. The punch

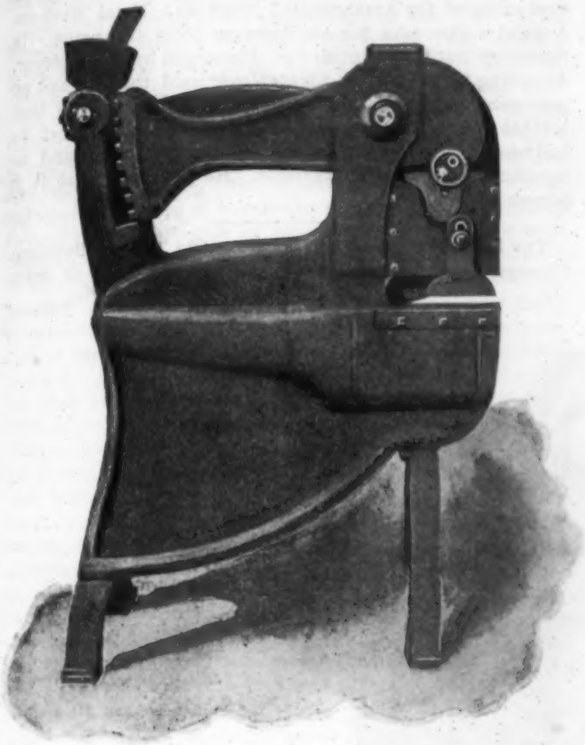


FIG. 1.—HAND POWER SHEAR.

is made in ten sizes, ranging in weight from 50 pounds to 6,000 pounds, and depth of jaw from 2 inches to 37 inches. Its range of capacity is from punching ¼-inch hole in ¼-inch iron to a 1-inch hole in 1-inch iron. The shear is one of a series made in three sizes. The size O cuts up to 3-16-inch plate, size A up to 5-16-inch, and size B up to ½-inch. It cuts plates of any width or any length, being a continuous shear. Both machines are made from new patterns and are designed for all kinds of sheet metal work, being strong and powerful.

They are especially adapted to the work of boiler makers, locomotive shops, ship builders and all other plate workers.

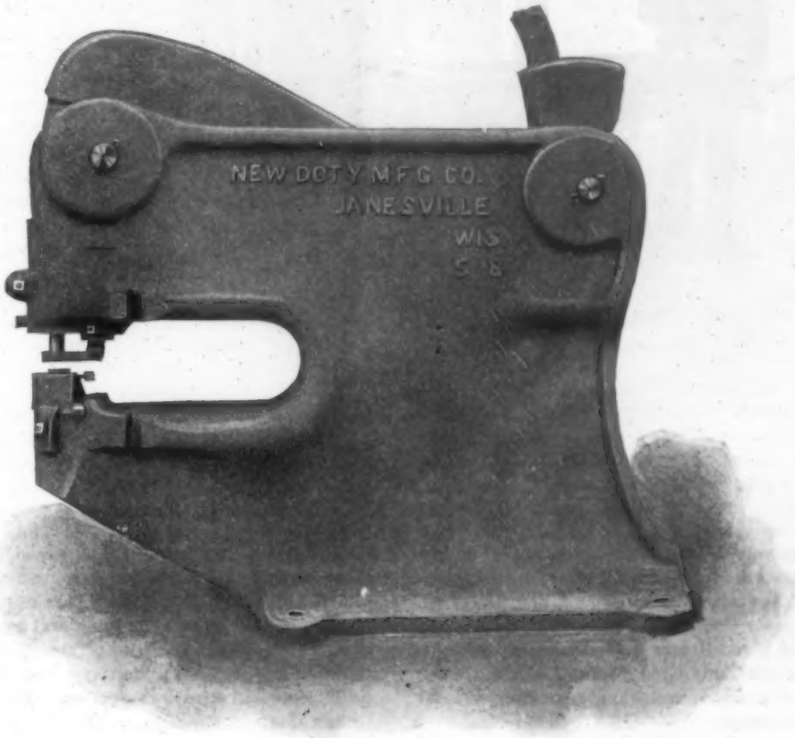


FIG. 2.—HAND POWER PUNCH.

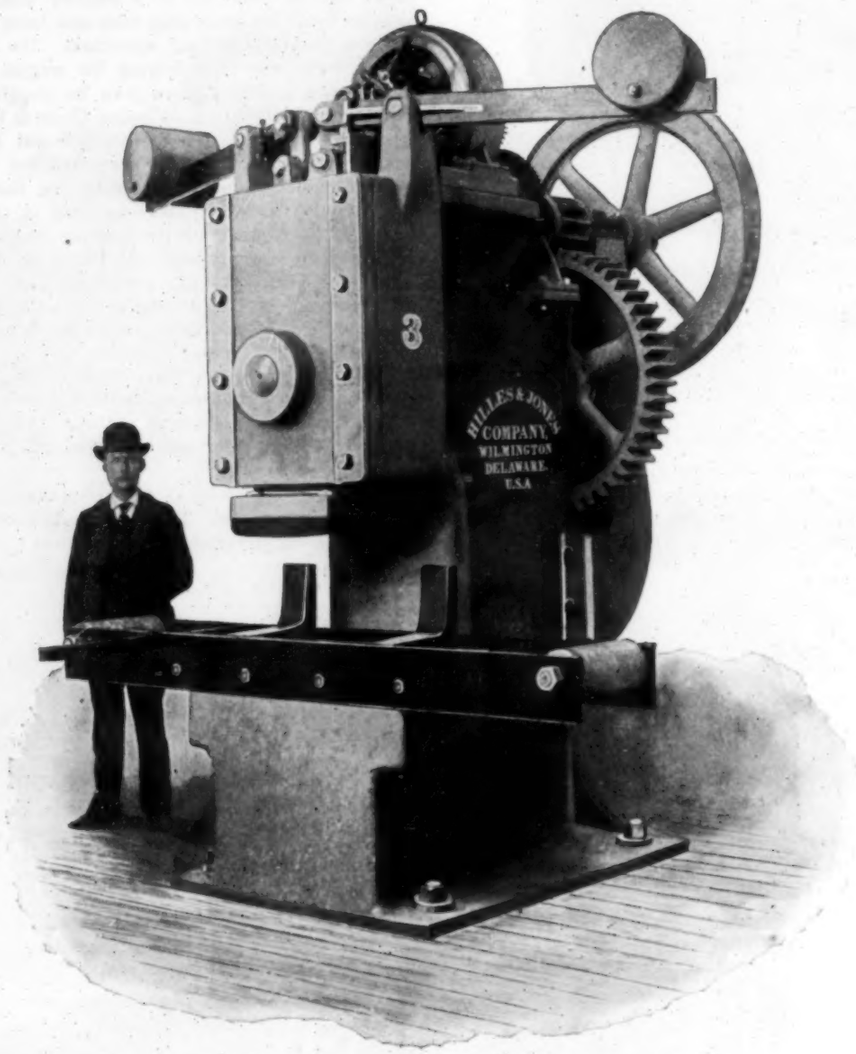
James H. Baker Mfg. Co.—After the transfer of the Baker Forge Co.'s plant to the steel car consolidation early in the present year, James H. Baker, who had sold his interest, became associated with H. M. Brackenridge and the James H. Baker Mfg. Co. was organized. Its new forge plant at Tarentum, Pa., is thoroughly modern. The buildings are of steel construction with brick walls. The company will manufacture railroad forgings and wagon hardware, carrying stocks of standard goods and stocks of iron and steel for manufacturing to order. A department will be devoted to die and shape designing and forging to order. Wrought anvils and a line of blacksmith's tools may become a part of the business later. James H. Baker, whose name is connected with a special wagon hardware and a special chain, began work in these lines as a country blacksmith in Ohio 25 years ago. He made edge tools and farm wagons, in addition to his blacksmithing operations. He started a small wagon works and from buying his wagon hardware from jobbers soon sold them more than he bought. He went to Pittsburg and organized the Baker Chain & Wagon Mfg. Co., which he sold out in 1890 on his removal to Chattanooga. The coming on of the panic prevented the development of his enterprise there and he organized the Baker Forge Co. in the Pittsburg district. This company in time made practically all the forgings for the steel car interests there. The officers of the new company, the James H. Baker Mfg. Co., are: H. M. Brackenridge, president; Jas. H. Baker, vice-president and general manager; and O. C. Camp, secretary and treasurer. The Pittsburg office is 503 Park Bldg.

THE report is denied that the Carnegie Steel Co., Pittsburg, has purchased the Santanillo & Moroto railroad and the Ponupo manganese ore mine, in Cuba. The company has an option on the mine, but has not closed any deal yet.

AT the coming session of Congress, the Navy Department will ask for 18 vessels. The department believes that in order to keep the sea power of this government from falling behind those of Germany and Russia the following ships should be authorized: Three armored cruisers, each 13,500 tons displacement; three protected cruisers, of 8,000 tons each; six gun boats of 1,000 tons, and six gun boats of 800 tons.

RAIL-STRAIGHTENING PRESS.

A new design of electrically-driven straightening press for standard T-head rails, 100-pound section and less, has been produced by the Hilles & Jones Co., of Wilmington, Del. The machine shown in the illustration is one of ten recently completed for a large rail mill, and is gotten up for heavy and ocntinuous service, the wearing parts being specially long and well supported. The sliding head is counterbalanced through cast steel levers. The block bolted to the ram or sliding head is also of steel, as are the dogs against which the rail is thrown. The rollers held in 8-inch x 1-inch bars form a substantial support for large rails and assist in handling the material. The whole machine is simply constructed and is very substantial for the class of work put upon it. The motor drives direct on the fly-wheel shaft through a pair of cut gears and is arranged for a speed on the sliding head of about 50 strokes per minute. The motor being placed on top of the main frame makes the tool entirely clear so that material may be handled in every position around it.



RAIL-STRAIGHTENING PRESS.

A CONTRACT has been given Fraser & Chalmers, of Chicago, by Mr. S. S. Fowler of the Ymir Gold Mines, Ltd., B. C., for machinery for a mill of 40 additional stamps, making a total ry.lling capacity of 80 stamps.

THE Amalgamated Association of Iron and Steel Workers has experienced a revival. Work has never been so pressing in their trade. Their wages have increased, and the new lodges formed since last spring number about 50. It is reported that the advances in puddling have materially increased the number of available puddlers. Many of them had sought other work as the pay for puddling declined. Mills are now much better able to run to full capacity.

AT Toledo, O., a unique suit has been started against a local union of the Amalgamated Sheet and Metal Workers. A metal worker asks $10,000 damages from the union. In November last the plaintiff was discharged by his employer. According to the petition, his employer said that he had no grievance against him, but the union had threatened to boycott the firm if Erne was retained. He complains that he had been rejected from membership in the union, and no substantial reason given therefor. He intimates that it is persecution.

THE Midland Rolling Mill Co., 360 Old Colony Building, Chicago, manufactures steel angle bars for iron or brass bedsteads, and for iron frame woven wire mattresses. It also rolls flats and rounds of various sizes. Its former mill was destroyed by fire the early part of this year, and it has just about completed rebuilding and has added greatly to the capacity, the new mill being of the most modern constrution throughout. The main building and machine shop are of brick, iron and steel construction. The plant is situated at Cragin Station, Chicago, on the Chicago, Milwaukee & St. Paul Railway Co., and within a short distance of the Belt Road, thus being most favorably loated for railroad facilities. This company has purchased the business of the Garden City Wire & Spring Co. The officers of the company are Allen R. Bancroft, president, and Douglas Charnley, secretary and treasurer.

MANUFACTURE OF STEEL CASTINGS.

A paper on the above subject was read on Nov. 11 at an engineering meeting at Manchester, Eng., by J. E. Feltcher, of Sheffield. From the published reports of the paper and the discussion we take the following:

The chief difficulty in the manufacture of steel castings, he said, was in connection with their contraction. The contractional co-efficient being roughly, double that of cast iron, very special means were necessary in order to release castings of large dimensions rapidly and successfully, whilst cooling. Mr. Fletcher then proceeded to examine the design of characteristic castings for hydraulic machinery, engines and boilers, mill work and electrical machinery, pointing out where difficulties in manufacture occurred, and suggesting how such troubles might be overcome. In connection with hydraulic cylinders he recommended that these should always be cast mouth upwards. By this means many of the weakest portions, viz., the closed end of the cylinder, was most likely to be perfectly sound, as it was thus subjected to the pressure of the whole of the cylinder body, and casting head above it. Again, the crystallization of the steel in the cylinder base was regular and the contraction more uniform. With regard to the casting of engine, boiler and pipe connections, the author said that in the navy the introduction of the Belleville boiler had led to the use of steel castings of most intricate form, some of which had been produced successfully; but with others, waster after waster had rewarded the founder's efforts. He believed he was perfectly correct in saying that on several occasions the completion of warships had been delayed simply on account of the difficulty in obtaining delivery of steel boiler castings of the intricate order above mentioned. From experience gained, the following conclusions had been arrived at: Pipes, tees, bends, and valve bodies of over 4-inch bore should not be less than ⅛-inch thick; under 4-inch bore, ⅛-inch; 6 to 8 inches, ¼ inch; 8 to 10 inches, ⅜-inch; 10 to 12 inches, 1-inch. The holes in all flanges should be drilled; the junction of the two boxes should be well rounded; and the coupling flanges kept as small as possible. In castings for locomotive purposes several articles had given considerable trouble, notably wheel centers, motion plates and bogie frame castings of more or less intricate form. The greatest difficulty was the production of wheel centers having heavy balance weights, the mass of these weights in many cases being enormously disproportionate to the remaining portions of the wheel. It was true that the steel founders had overcome the difficulty partially, and such wheels could be cast free from flaw, but it was extremely doubtful whether they were ever free from the severe strains set up during contraction, however well the castings were annealed.

Dealing with the casting of spur and bevel wheels for millwright's use, Mr. Fletcher said the thickness of arms and rims should be as nearly as possible uniform, H section arms were the best, neither the X nor the elliptical sections being satisfactory. It was advisable to core out the steel at the end of the arm web, leaving the side flanges to transmit the power. The radius of the arm end next the rim should be as large as possible. Wheels over 4 feet 6 inches in diameter should have their shaft-bosses or eyes split and afterwards hooped. The continental plan of adopting an odd number of arms was recommended, such wheels, as a rule, being more truly circular than wheels having an even number of arms. Wheels in halves should be cast in one piece, afterwards being sawn or drilled apart at the rim. The arms of bevel wheels should be of H-section, and where the wheels had very flat faces the rims should be stiffened. Steel wheels with disc centers were not to be recommended, fracture in cooling being of constant occurrence. In conclusion, the author remarked that, in considering various representative castings, the question of crystalline structure played an important part. In fact, wherever in a casting weak zones of crystallization occurred, there was a risk, to a greater or less extent of fracture. This risk might be minimized by annealing, only he was strongly of opinion that all steel castings should be well annealed. The demand for very mild steel castings giving high ductility had in some cases been carried too far, intricate forms of rapidly changing section, when cast in such mild steel, being very likely to fail; indeed, it might be taken as certain that the mild qualities of steel developed cracks more readily than the harder ones. The production of steel castings would be carried on more successfully as the laws of cooling in relation to crystalline structure became more widely known. Steel founders, with all other metal founders, were seriously hampered by the appalling general ignorance (on scientific subjects) of the molders. It was high time the molders realised their position in this respect, and applied themselves to the task of gaining knowledge respecting metallurgy, heat and machine design. With intelligent molding, suitable steel, and a grasp of the laws of cooling and crystallization, when dealing with the releasing and annealing of castings, steel machine details, if carefully designed, would be perfectly produced in the future.

In the discussion on the paper Mr. James Saxon agreed with the author as to the advisability of splitting the bosses of wheel castings for millwrights, and also as to the advantage of having an odd number of arms. Mr. Ingham remarked that boiler insurance companies had for a long time looked with great suspicion on steel mountings for boilers, owing to the great trouble that had often been caused by their adoption. He would like to know the author's opinion of electric welding for patching up defective castings. Mr. Parry said the most difficult locomotive casting to deal with was the radial axle box. Mr. J. Bates said a gentleman had been telling him the other day that they had been casting 24 hydraulic cylinders and only about six proved good ones. Now he was inclined to ask if they could make six good ones out of 24, why should they not make, say, 20 good ones and only four bad ones? They used the same fuel, material and men. Why could they not produce the same results? Mr. Whittaker expressed the opinion that 25 per cent of bad steel castings were due to the steel being badly melted in the furnace. He also thought it would be advantageous if the molders were more often called in and consulted about the construction of a pattern.

Mr. Alfred Saxon said that for certain classes of engine work, engineers would not adopt steel castings unless they could be produced lighter than cast iron; this was more particularly the case as regards pistons for horizontal engines. Mr. Milton was not of the opinion that there was any virtue in having an odd number of arms in wheels for millwright's requirements. Mr. Hodgson thought the foreman molder ought to be taken more into confidence by those who were designing the work. Steel castings had come as a god-send to engineers, and had dispensed with a large amount of cast smithwork. Mr. Daniels thought hydraulic cylinders were best when cast with the head down. Mr. Beard said with regard to the difficulties in steel molding as compared with iron molding, it was simply a matter of going to school again with a material contracting twice as fast and a little rougher to deal with. Mr. Whitehead said he though a good deal of trouble in steel casting arose from the hard sand, or compound, with which the mold is made. With regard to wheels he did not think a steel rim would be very much good unless it was cast in a piece and afterwards divided. Mr. Walsh asked the author how he would split a wheel with an odd number of arms.

Mr. Fletcher, in replying, said the different results obtained in castings with the same method of molding, casting and releasing, were largely due to difference of the temperature at which the castings set. In the case of large defects he would not recommend electric welding, but in making good any small defects that could be properly got at, it was perfectly satisfactory. With regard to the odd number of arms on wheels, he believed the Germans made a practice of splitting between every arm and hooping, and theoretically he thought that was the only way out of the difficulty, although no doubt a wheel with five arms might be safely split in, say, three places. The president, in proposing a vote of thanks to Mr. Fletcher, urged the advisability of taking the molder more into confidence in connection with steel castings.

At Lockport, N. Y., an issue has been raised by the molders of the Holly Mfg. Co. and efforts are being made to adjust the trouble. A stubborn strike is on at the Central Foundry, Medina, N. Y. State arbitrators are on the ground. The foundry company refuses to recognize the union.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

A new corporation has been formed at Thompsonville, Conn., to be known as the New England Machine Screw Co., with a capital stock of $10,000, consisting of 100 shares of $100 each. The company is to manufacture tools and hardware.

The Globe Machinery & Supply Co., Des Moines, Ia., has started a machine shop which has been equipped with new tools.

Birmingham (Ala.) Gas Retort Mfg. Co. will be in the market for machinery for the manufacture of bolts, nuts and pipe fittings.

Valley Iron Works, Williamsport, Pa., are in the market for a second hand throttling engine of from 250 to 300 h. p.

Vinsen & Petoie, Benwick, La., are building blacksmith and machine shops and will purchase some equipment.

The Knoxville (Tenn.) Iron Co. wants bids on two shears (new and second hand), that will cut 1¼-inch rounds.

Geo. M. Henrie, 34 W. Washington st., Chicago, wants small iron planer and 4-inch iron lathe.

The American Bell & Foundry Co., of Northville, Mich., is the name of a new company just organized. It has purchased the bell and foundry business of the Globe Furniture Co. The following are its officers: Frank S. Harmon, president; Charles S. Filkins, vice president; Louis A. Beal, secretary; Edward H. Lapham, treasurer.

Johnson & Noyes, 1522 Monadnock Block, Chicago, are in the market for a second hand double ended punch and shear, with cut off 8 inches by 1 inch, and to punch ⅝ inches by 1 inch. It should have at least 20 inch throat, and must be in good condition.

New Construction:—

It is reported that a large machine shop will be erected by W. H. Hendricks, at York, Pa.

Oliver Bros., of Lockport, N. Y., will rebuild the brass and iron bedstead factory which was destroyed by fire last August, and the new plant will be one of the finest in the country.

A forge shop for the Steele & Johnson Mfg. Co., Waterbury, Conn., is under way.

The Copper & Brass Rolling Mills at Detroit, Mich., are to be enlarged by a two-story addition, 60x100 feet, costing $10,000.

It is rumored that the Pullman Palace Car Co. is considering a proposition to build a large plant at Denver, Col.

New machine and boiler shops now under erection at the steel plant of the Colorado Fuel & Iron Co., Pueblo, Col., will be completed by the first of the year.

The Gruson Iron Works, incorporated in May under the laws of New York with a capital of $500,000, will push construction work at the site purchased recently at Eddystone, Pa., on the Delaware. There will be a large foundry for the casting of chilled faced turrets, made from charcoal iron, and a machine shop. The directors of the company are: P. H. Griffin, of P. H. Griffin Machine Works, Buffalo, N. Y.; Thomas Prosser, representative of Fried. Krupp, for the United States, New York City; C. W. Barnum, of Messrs. Barnum & Richardson, Lime Rock, Conn.; T. Guilford Smith, vice-president New York Car Wheel Works, Buffalo, N. Y.; A. E. Piorkowska, Capt. I. G. A., representative of Fried. Krupp Grusonwerk, Madgeburg, Germany; Ernst Thalmann, Messrs. Ladenburg, Thalmann & Co., New York; David Townsend, Philadelphia; S. Singer, Paris, France; Herbert L. Satterlee, of Ward, Hayden & Satterlee, New York. The Fried. Krupp Grusonwerk of Madgeburg, it is understood, holds a one-fifth interest.

Work was begun last week on a new foundry at Millbury, Mass., for H. T. Merriam. It will be somewhat larger than the old foundry which occupied the same site.

Contracts have been let for the erection of a building for the Diamond Stamp Works, of Detroit. The building will be three stories, 80x200 feet, and will cost $30,000.

John A. Schulte & Co., of Cincinnati, are about to erect a plant valued at $4,000. The structure will be of brick and stone, 62x107 feet, and one story.

A new plant for the manufacture of bench hardware is in course of erection at Wrightsville, near Columbia, Pa. It will give employment to 100 molders.

The Day-Ward Co., Warren, O., manufacturers of bath tubs, has decided to make extensive additions to its plant.

The Milwaukee Harvester Works have secured a permit for the erection of an addition 218x66 feet, 80 feet high, to cost $45,000.

Fires and Accidents:—

The main foundry room of the A. E. Shorthill & Co., located at Marshalltown, Ia., was destroyed by fire last week. The loss is estimated at $2,500, fully insured.

The foundry of the Lakeside Iron Co., Muskegon, Mich., burned Nov. 14. Loss, $8,000; insurance, $2,000.

Fire at the Grand Island Foundry, Grand Island, Neb., Nov. 7, caused $4,500 loss, partly insured.

The Pittsburg District:—

The plant of the Riter-Conley Mfg. Co. has been operated day and night for more than a year, the capacity of the structural shops meantime being doubled. It is reported that the company has in hand more than $5,000,000 worth of foreign contracts.

W. M. Kerr, Pittsburg, representing the McNeil Boiler Co., of Akron, O., builders of the Cook vertical water tube boiler, reports recent contracts including 2,400 h. p. Cook boilers erected in one battery and equipped with automatic furnaces at the National Tube Works Co., McKeesport, Pa.; 500 h. p. Cook boilers at the Wheeling Steel & Iron Co.; 150 h. p. Cook boilers at the Republic Iron Works Co., Pittsburg.

The Pittsburg Milling Co. was chartered last week with $5,000 capital stock. The directors named are Edward K. Dick, Greensburg, and William J. Kerr, L. H. Matthews, John M. Freeman and John W. Chalfant, Pittsburg.

Arrangements will probably be made for handling the export business of the Pressed Steel Car Co. in London. The company feels that there is a good field abroad for steel cars manufactured here owing chiefly to the economies brought about through their use. The proportion of live freight to the total weight of pressed steel cars of the type generally used here is about 68 per cent. With many cars in use upon European railways the percentage is only about half that figure. In entering the foreign markets the Pittsburg company has an advantage in low cost of steel. The Pressed Steel Car Co. is now turning out about 80 steel cars a day. The new plant at McKees Rocks now has a capacity of about 40 cars a day, varying according to style and size of the car. Changes in the Joliet, Ill., plant that are now being made provide for the manufacture of the complete steel cars there to the extent of about 20 a day. Heretofore this plant has been making trucks, frames, etc., but in April or May next year the plant will be operating on cars.

The machine shop of the Hydraulic Machine Co., 54th st., Pittsburg, was destroyed by fire early last Sunday morning, causing a loss of about $20,000, fully covered by insurance. The burned portion will be rebuilt at once. Henry Aiken is the principal owner.

The Drake & Stratton Co., Ltd., Pittsburg, has just made a contract with the Fayal Mining Co. to strip 2,500,000 yards of earth, rock and gravel from its Mesabi property. The contract is said to amount to $1,250,000. The company has already done about 1,600,000 yards of stripping for this interest.

Application will shortly be made for incorporating the Pittsburg White Sand Co. by C. W. Phillips, J. E. Umstaetter, Willis F. McCook, W. L. Merwin and B. J. Jarrett. The company will develop white sand deposits in Huntingdon county, Pa.

A patent has been issued to the Carbon Steel Co., Pittsburg, for about two and one-third acres of land in Pittsburg, facing the Allegheny river, and adjoining its property. The land was made by filling in for a number of years. There was formerly an island in the river at this point, which was washed away, and the space filled in was formerly occupied by the channel between the island and the bank. The patent was granted through the operation of a law passed in

Cross Section

End View.

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Side Section.

1897. The land is worth about $50,000 an acre. The first grant of land under the law was made to William F. Aull, who secured a patent for a strip of 13 acres of land opposite the Upper Union Works, Pittsburg, of the Carnegie Steel Co., and just above the strip of the Carnegie Steel Co. The Carnegie Steel Co. endeavored to prevent the granting of the patent to Mr. Aull, but failed, and afterwards made an arrangement with him whereby it secured the land.

Chicago District and Northwest:—

The E. P. Allis Co., Milwaukee, are about to erect a $20,000 addition to their machine shop.

The Board Cummings Foundry Co., of Chicago, will erect a boiler house, blacksmith shop and a two-story brick machine shop.

Fraser & Chalmers, Ltd., report for the fiscal year a surplus of £56,000 after payment of debenture interest and preferred dividends. Common dividends were passed in view of the war in the Transvaal, where the company has large interests.

The Stockham Mfg. Co., of Chicago, has made plans for an extensive addition to its foundry at 2577 to 2601 Grand ave. It will comprise a foundry one-story high, 100x300 feet in size. It will be of brick, and will cost $15,000.

The Thomas Belting Co. has been incorporated at Chicago, with a capital stock of $25,000, to manufacture leather belting and supplies. The incorporators are John M. Thomas, George O. Thomas, and James B. Gascoigne.

The Rockford Bit Co. has been incorporated at Chicago, with a capital stock of $5,000, to manufacture bits, boring tools and machinery. The incorporators are William B. McIlvaine, Nathan G. Moore and Houston C. Adcock.

The American Steel & Wire Co. has announced that its Waukegan, Ill., wire mill, which was recently burned, will be rebuilt at once. A large force has been set at work clearing away the debris. The plant when completed will employ more than 1,000 men. Among the new installations will be a 3,000 h. p. engine, and an electrical power house.

The Beloit Iron Works, Beloit, Wis., has received a contract for building two paper machines for a paper and pulp mill in China. The machines will cost $60,000.

Insurance to the amount of $242,750 has been paid to the American Steel & Wire Co., in full settlement of its losses sustained by the burning of its plant in Waukegan, Ill. The total insurance was $364,000, and covered some of the property that was saved.

General Industrial Notes:—

The Anniston, Ala., plant of the Southern Car & Foundry Co. has received an order from the Pressed Steel Car Co., of Pittsburg, for the forgings for 1,000 cars.

John W. Logan has transferred to the Logan Mfg. Co., Phoenixville, Pa., a tract of land on which a plant will be erected for the manufacture of steel by the so-called Logan process.

The Potomac Steel Co., after spending $40,000 in repairs, has started up the rail department of the Cumberland rolling mill at Cumberland, Md.

The Craig-Reynolds Foundry Co., of Dayton, O., has sold its plant to Orr, Painter & Co., of the Reading Stove Works, Reading, Pa. The latter company will make all the stoves going to its Western trade at the Dayton plant.

The Solvay Process Co., Detroit, announces information that the present soda ash works in Delray, a suburb of Detroit, will be duplicated.

The Ferracute Machine Co., Bridgton, N. J., is reported to have plans for a new plant that will include in addition to operating departments a reading room, pool room and gymnasium.

Two buildings are up, of the plant the Massillon (O.) Iron & Steel Co. is erecting. The pipe foundry will be completed by the end of the year.

The S. Morgan Smith Co. is about to add an extensive foundry to its plant at York, Pa.

Fort Plain, N. Y., is to have an iron foundry. The building will be 50x100 feet, and of wood.

The foundry and machine shop departments of the Binghampton, Tenn., car works are about ready to start up.

Charles Forsman, of Sharon, Pa., goes to Chihuahua, Mex., to assume the management of the melting department of the open-hearth steel mill owned by the Mexican Industrial Co. This is the first open-hearth steel plant erected in Mexico.

The Birmingham (Ala.) Machine & Foundry Co. will manufacture blowing engines.

No. 6 blast furnace of the Bethlehem Steel Co.'s plant at South Bethlehem, Pa., is about to go in blast.

The two Saxton furnaces located at Saxton, Bedford county, Pa., which have been idle for a number of years, are to be put in operation as soon as repairs can be made.

The contract for the electrical machinery and appliances for the new Sharon Steel Works, Sharon, Pa., now in process of erection, has been awarded to the Seimens-Halke Co., of Chicago. Among the equipment are two generators of 600 k. w. each.

The location of a rolling mill at Kansas City is being agitated. J. E. Jones, representing Chicago capital is conferring with local interests. The proposed site is near that of the new plant of the Weber Gas & Gasoline Engine Co. The latter company is planning to manufacture automobiles.

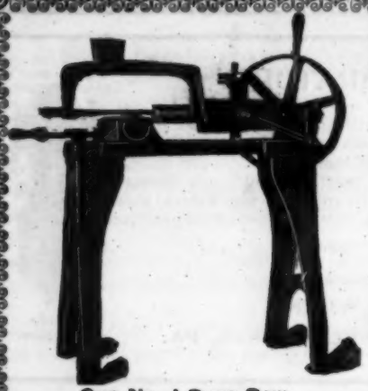
Dora Furnace, located at Pulaski, Va., resumed last week after being out for repairs. Dora Furnace has been in operation for eight years, producing 424,000 tons of iron, or an average of 53,000 tons a year.

Plate work on the third furnace of the National Steel Co. at Youngstown, O., began last week, the Wm. B. Pollock Co. having the contract. The Enterprise Boiler Co. will erect the stoves.

The Penn Bridge Co., of Beaver Falls, is re-erecting the steel work shipped from Alexandria, Ind., for the Bessemer plant now going up at the Brown-Bonnell plant of the Republic Iron & Steel Co., Youngstown, O. Boilers have been shipped and are being put in position.

The Central Iron & Steel Co. has begun the erection of two additional furnaces in the 126-inch mill at its works in South Harrisburg, Pa. The mill contains three large furnaces, and the new ones will be about the same size. The company is also building a large frame stock shed at the mill.

The Buckeye Engine Co., of Salem, O., through its Pitts-



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Chicago.

New York.

burg office, has recently taken orders for a 17½x18-inch, 225 h. p. engine, to the Carbon Steel Co., Pittsburg; three tandem compound condensing engines, 18¾x32½x36 inches, 500 h. p., to the Carnegie Steel Co., Ltd., for the Carrie furnaces at Rankin, Pa., and two tandem compound condensing engines, 20x36x36 inches, 650 h. p., to the Carnegie Steel Co., Ltd., for the Duquesne steel plant.

It is thought that the new mill of the Chester Rolling Mill Co., at East Liverpool, O., will begin operations about March 1.

It is reported that the steel plant at Ensley City, Ala., will be making steel within a week. The rod and wire mills adjoining the steel plant will not be able to get into operation until early next year.

Extensive improvements have been under way at the Brown-Bonnell plant of the Republic Iron & Steel Co., Youngstown, O., for the past five months, and the mill is now in full operation for the second time since July 1. The bar mill has been much improved. In the furnace department the three-door coal furnaces have been replaced by four-door gas furnaces.

The Portland Rolling Mills, Portland, Me., recently burned, will not be rebuilt. The site will be sold.

The Carter Steel & Iron Co., organized at Knoxville, Tenn., with a capital of $600,000, and the privilege of increasing it to $5,000,000, has absorbed the Blue Springs Mining Co., the Helen Maud Iron Co., the Stoney Creek Iron Co., and secured valuable iron mines in Carter county, Tenn. New York capitalists are reported to be interested.

Craig Ridgway & Son Co., Coatesville, Pa., has been incorporated with $100,000 capital by C. Ridgway, .W H. Ridgway, A. C. Ridgway, E. B. Ridgway, S. W. Ridgway, all of Coatesville.

The Betts Machine Co., Wilmington, Del., has shipped one 7-foot and one 6-foot boring and turning mill to De Fries & Co., Dusseldorf, Germany; one 7-ft. boring and turning mill to Baltimore & Ohio Railroad, Newark, O.; one 6-ft. boring and turning mill to El Paso Foundry & Machine Co., El Paso, Tex.; one 6-ft. boring and turning mill to Dimmick Pipe Co., Birmingham, Ala.; one 7-ft. boring and turning mill to St. Mary's Machine Co., St. Mary's, O.; one 6-ft. boring and turning mill and one large radial drill to U. Baird Machinery Co., Pittsburg, Pa.; one 1,100 pound steam hammer to Harlan & Hollingsworth Co.

It is reported that a serious strike is threatened at the Michigan Peninsula plant of the American Car & Foundry Co., in Detroit. The trouble arose over the discharge of 20 men who represented the union in some demands that were made of the company. The employes, it is reported, will demand the reinstatement of the discharged men, and will strike if their demands are not granted.

Large shipments of Lake Champlain iron ore are being received at the furnaces of the Lackawanna Iron & Steel Co., the Colebrook furnace in Lebanon, and the Bird Coleman and North Cornwall furnaces at Cornwall.

The Haven Malleable Iron & Castings Co., Cincinnati, has increased its capital stock from $50,000 to $75,000.

The recently incorporated Vesuvius Charcoal Iron Co., which has leased the Vesuvius Furnace at Ironton, O., has elected the following officers: David Halley, president and general manager; John O. Yates, vice-president; W. P. Lewis, secretary and George N. Gray, treasurer.

The recently incorporated Columbus Steel & Iron Co. elected H. A. Marting, president; F. H. Miller, vice-president and general manager; Walter Marting, secretary; Otto Marting, treasurer. Work on the plant will be commenced at once and will be pushed to completion. It is expected that both furnaces will be in blast next June or July. The daily capacity will be 300 tons.

The *Railroad Gazette* notes that the Pecos Valley & Northeastern is in the market for 300 stock cars and the Virginia & Southwestern for 500 coal, coke, flat and box cars; the Kansas City, Memphis & Birmingham will order 500 box cars; the White Pass & Yukon is building 80 box and stock cars

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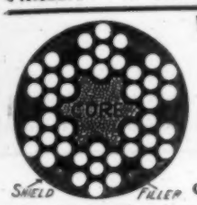

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and 20 flat cars; the Kansas City, Pittsburg & Gulf has ordered 1,500 box cars; the Atlantic, Valdosta & Western is in the market for 200 box cars; the Southern Railway is in the market for 650 box cars, 1,000 gondola cars and 500 flat and stock cars; the Kansas City, Pittsburg & Gulf will order a large number of cars as soon as the reorganization is completed; the C. B. & Q. is building 200 furniture cars; the Chicago & Alton will order 1,700 cars more; the Ann Arbor has ordered 200 coal cars; J. W. Ellsworth & Co., of Cleveland, O., have placed an order for 500 coal cars; the Chicago & Alton has ordered 300 more stock cars from the Mt. Vernon Car Mfg. Co., in addition to 300 recently noted and also 800 steel cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Blast Furnace as a Power Producer.

In an article in *Feilden's Magazine*, of London, for October, the Thwaite-Gardner system, invented by B. H. Thwaite, is described. We quote from a condensation by the *Engineering News:* The average composition of furnace gas is given as: Nitrogen, 57.7 per cent, carbon dioxide 7.8 per cent, carbon monoxide 30.7 per cent, hydrogen 3.3 per cent and marsh gas .5 per cent. The thermal value of the different combustible gases per cubic foot measured at 60° F., when the products of combustion are considered as not lower than 212° F., is: Carbon monoxide, 319 B. T. U.'s; hydrogen, 228 B. T. U.'s, and marsh gas, 908 B. T. U.'s. The blast furnace gas then has a value of about 120 B. T. U.'s per cu. ft., and, when employed to drive gas engines, will give from 60 to 70 lbs. per sq. in. mean pressure in the cylinder, and not over 100 cu. ft. will be required horse-power hour. Where coke is the fuel employed, there are given off from 170,000 to 180,000 cu. ft. of gases for each ton of coke consumed. Thus, a furnace producing 600 tons of pig iron per week and using one ton of coke per ton of iron would deliver about 600,000 cu. ft. of gases per hour. Allowing one-third of this for heating the blast by combustion in fire-brick hot-blast stoves, there is left 400,000 cu. ft. for power purposes, which would produce, if used in gas engines, 3,500 to 4,000 h. p., of which 300 h. p. would be needed for supplying the blast and other purposes,

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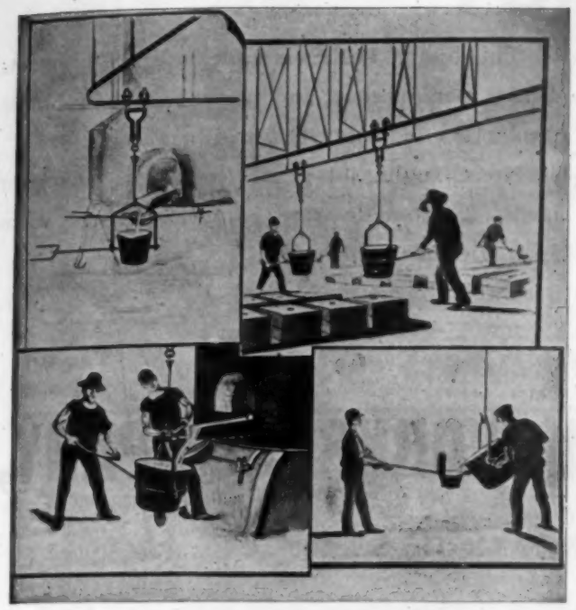

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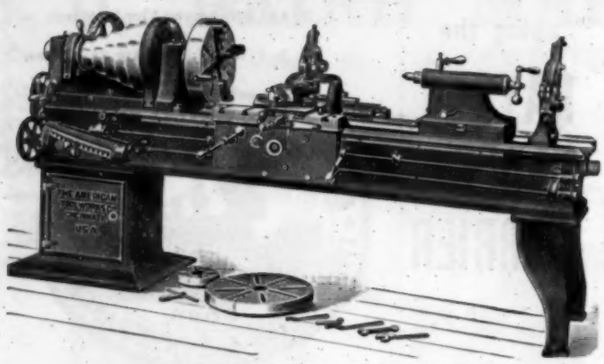

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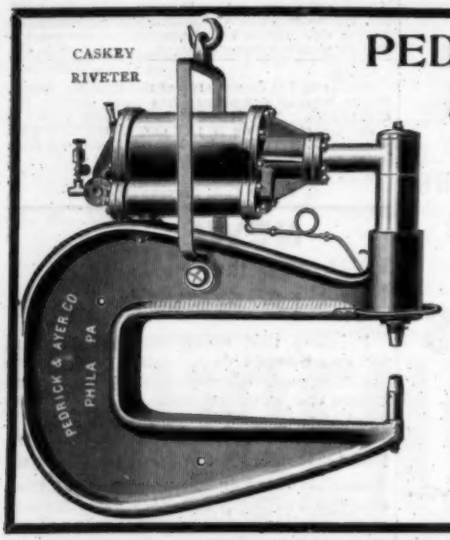

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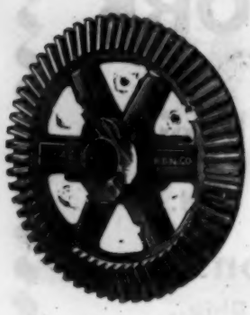

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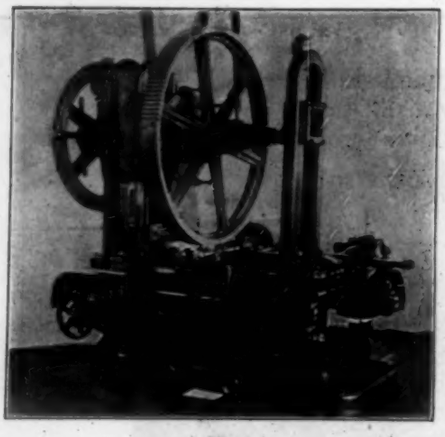

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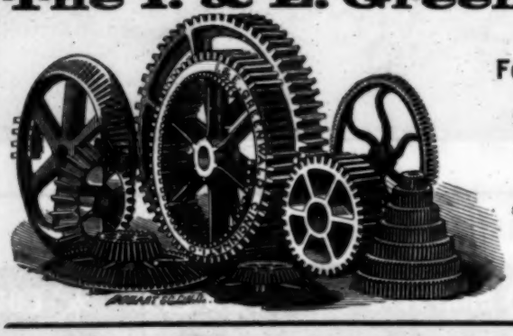

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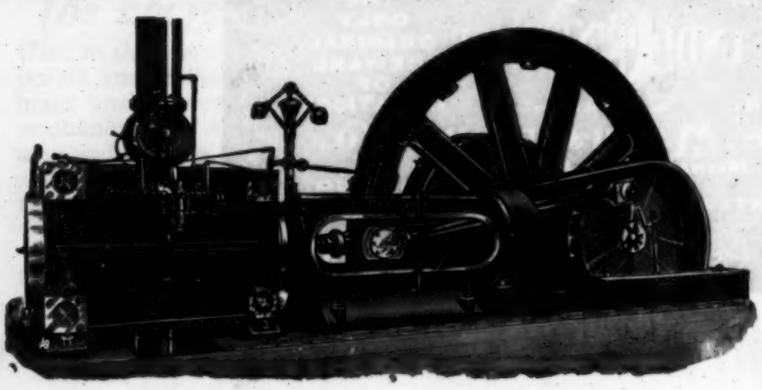

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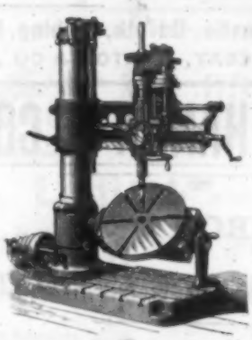

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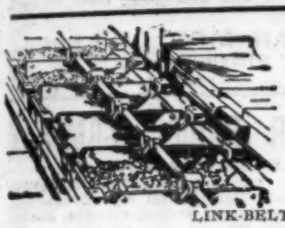

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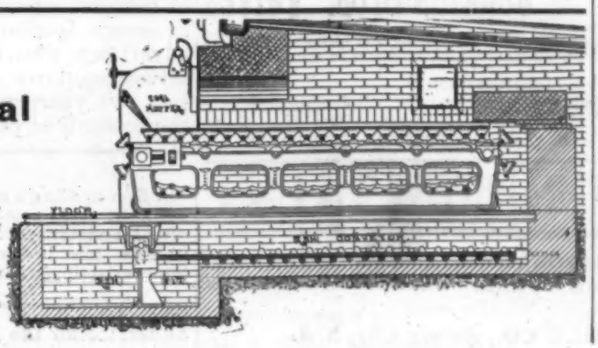

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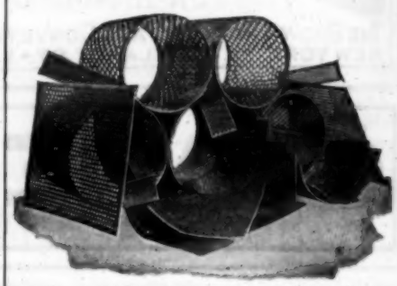

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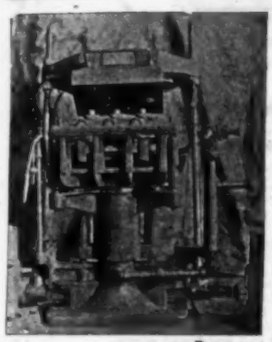

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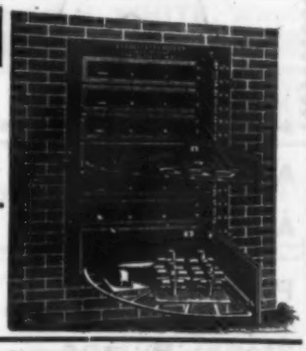

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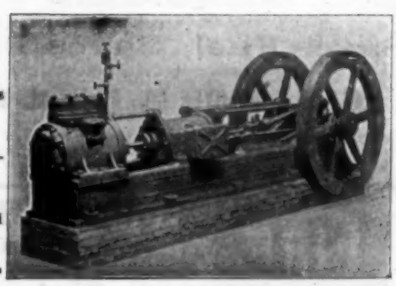

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HANDBOOK

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In the preparation of the second edition of our Handbook, the general plan of the first edition has been followed, viz., to present in concise form such data and information as are useful to the chemist and metallurgist. Several tables of the first edition, which were of somewhat limited use, have been omitted, while more than one hundred pages of new matter have been added.

The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognized at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

Numerous miscellaneous tables have been added, which, it is hoped, will be found of value

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Chain Works,
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Car Wheel Works, and
Car Builders in the United States.

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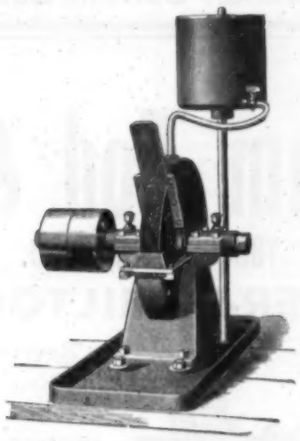

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No. 1 American Scotch	23.00@ 23.50
No. 2 American Scotch	22.25@ 22.75
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[Delivered Cleveland.]	Gross Tons.
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No. 1 Machine cast scrap	17.00
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Cast borings	11.00
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1 to 1⅞	2.50 Base.
2 to 2⅞	.20 extra.
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4½ to 5	1.30 "
5⅛ to 6	1.80 "
6⅛ to 6⅜	2.20 "
6½ to 7⅜	2.50 "
¼ to ⅜	.10 "
⅞ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 1-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

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1¼ to 4 x ⅛ to 1	1.05 Base
4¼ to 6 x ⅛ to 1	.10 extra
6¼ to 8 x ⅛ to 1	.60 "
8¼ to 10 x ⅛ to 1	.80 "
1¼ to 4 x 1 1-16 to 1¼	.30 "
4¼ to 6 x 1 1-16 to 1¼	.40 "
6¼ to 8 x 1 1-16 to 1¼	.60 "
8¼ to 10 x 1 1-16 to 1¼	.90 "
2 to 4 x 1⅜ to 2	.50 "
4¼ to 6 x 1⅜ to 2	.60 "
6¼ to 8 x 1⅜ to 2	.80 "
8¼ to 10 x 1⅜ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1¼ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅞	.20 "
¼ to 15-16 x ⅜ to ⅞	.40 "
⅝ to 11-16 x ⅜ to ⅞	.50 "
½ to 9-16 x ⅜ to ⅞	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1¼ to 4 x ¼ to 5-16	.20 "
1 to 1¾ x ¼ to 5-16	.30 "
¼ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. Bevel Edge Shaft Iron 1-10 higher than same size of Heavy Bands.

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7 to 8 x No. 9 to 3-16	c (if)
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "

1 6 to ¼ x No. 9 to 3-16.....1.30 extra
7-16 to ½ x Nos. 10, 11 and 12.....1.40
⅝ x No. 9 to 3-16.....1.50
⅝ x Nos. 10, 11 and 12.....1.60

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Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.....
Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1⅛.....40 extra
¼ to 13-16.....50 "
⅜ to 11-16.....60 "
¼ to 9-16.....80 "
⅜ to 7-16.....1.10 "
¼ to 9-16 x 3-16.....1.00 "
⅜ to 11-16 x ⅜.....1.20 "

Half Oval and Half Round.

2¼ to 3.....60 extra
⅞ to 2.....50 "
¼ to 13-16.....70 "
⅜ to 11-16.....90 "
¼ to 9-16.....1.20 "
⅜ to 7-16.....2.50 "
5-16.....3.50 "
¼.....4.50 "

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Horse Shoe Iron.

All sizes.....1 c. extra.
Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width in Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base.
		Extras.
1¼ to 6,	" 10, 11, 12 or ¼"	.05 per 100 lbs.
1 to 1¼,	" 7, 8, 9 or 3-16"	.10 "
1 to 1¼,	" 10, 11, 12 or ¼"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10, 11, 12 or ¼"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45 "
½, Nos.	7, 8, 9 or 3-16"	.55 "
½, "	10, 11, 12 or ¼"	.60 "
7-16 "	7, 8, 9 or 3-16"	.75 "
7-19 "	10, 11, 12 or ¼"	.85 "
⅜, "	7, 8, 9 or 3-16"	.95 "
⅜, "	10, 11, 12 or ¼"	1.05 "

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.	
7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base
		Extras.
7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs
7-16 to 2,	" 20	.10 "
7-16 to 2,	" 21	.15 "
7-16 to 1¾,	" 22	.25 "
½ to 1¾,	" 13, 14 and 15	.05 "
½ to 1¾,	" 16, 17 and 18	.10 "
1¼ to 1⅜,	" 19 and 20	per 100 lbs.
1¼ to 1⅜,	" 21	.20 "
1¼ to 1⅜,	" 22	.30 "
15-16 and 1,	" 13, 14 and 15	"
15-16 and 1,	" 16, 17 and 18	.15 "
15-16 and 1,	" 19 and 20	.20 "
15-16 and 1,	" 21	.25 "
15-16 and 1,	" 22	.35 "
⅝, Nos.	13, 14 and 15	.20 "
⅝, "	16, 17 and 18	.25 "
⅝, "	19 and 20	.30 "
⅝, "	21	.35 "
⅝, "	22	.45 "
⅝ and 13-16	Nos. 13, 14 and 15	.30 "
⅝ and 13-16	" 16, 17 and 18	.35 "
⅝ and 13-16	" 19 and 20	.40 "
⅝ and 13-16	" 21	.45 "
⅝ and 13-16	" 22	.50 "
⅝ and 13-16	" 23	.60 "
11-16,	Nos. 13, 14 and 15	.35 "
11-16,	" 16, 17 and 18	.40 "
11-16,	" 19 and 20	.50 "
11-16,	" 21	.60 "
11-16,	" 22	.70 "
11-16,	" 23	.80 "
⅝,	Nos. 13, 14 and 15	.40 "
⅝,	" 16, 17 and 18	.45 "
⅝,	" 19 and 20	.55 "
⅝,	" 21	.65 "
⅝,	" 22	.75 "
⅝,	" 23	.85 "
9-16,	" 13, 14 and 15	.45 "
9-16,	" 16, 17 and 18	.50 "
9-16,	" 19 and 20	.60 "
9-16,	" 21	.70 "
9-16,	" 22	.80 "
9-16,	" 23	.90 "
⅝,	" 13, 14 and 15	.55 "
⅝,	" 16, 17 and 18	.60 "
⅝,	" 19 and 20	.70 "
⅝,	" 21	.80 "
⅝,	" 22	.90 "
⅝,	" 23	1.00 "
7-16,	" 13, 14 and 15	.80 "
7-16,	" 16, 17 and 18	.90 "
7-16,	" 19 and 20	1.00 "
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½,	" 16, 17 and 18	1.10 "
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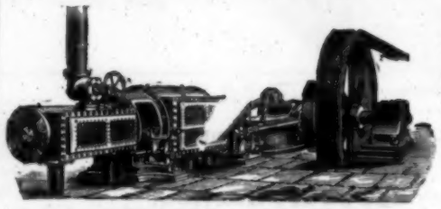

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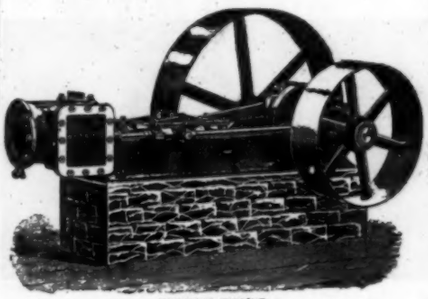

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Excelsior Iron Works Co., Cleveland, O.

CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

CAR UNLOADERS—
Excelsior Iron Works Co., Cleveland, O.

CAR WHEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Chicago, Ill.

CARRYING TONGS—
Vulcan Mfg. Co., Pittsburg, Pa.

CASE HARDENING MATERIALS—
American Carburizing Co., New York City.

CASTINGS—
Seaman-Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
Macbeth & Co., Cleveland, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Lorain Foundry Co., Lorain, O.
Bethlehem Steel Co., South Bethlehem, Pa.

CASTINGS (ALUMINUM)
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRASS)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co Lorain, O.

CASTINGS (BRONZE)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

CASTINGS (MALLEABLE)—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.
Forster, Waterbury & Co., Chicago, Ill.

CEMENT—
The Brier Hill Iron & Coal Co., Youngstown, O.
Garden City Sand Co., Chicago, Ill.
Reed F. Blair & Co., Pittsburg, Pa.

CHAIN HOISTS—
Reading Crane & Hoist Works, Reading, Pa.

CHAIN BELTING—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
Buhl Malleable Co., Detroit, Mich.

CHANNELERS—
The Ingersoll-Sergeant Drill Co., New York.

CHEMISTS—
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
John T. Jones & Co., Chicago, Ill.
Cremer & Bicknell, Cleveland, O.
We Fu Go Co. Cincinnati, O.

CHILLED AND SAND ROLLS—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Riverside Foundry Co., Cleveland, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips Sons' Co., Philadelphia, Pa.
Lorain Foundry Co., Lorain, O.

CHUCKS—
Skinner Chuck Co., New Britain, Conn.

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.

COAL SCREENS—
Rob't. Aitchinson Per. Metal Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

COAL AND COKE—
M. A. Hanna & Co., Cleveland, O.
Rogers, Brown & Co., Cincinnati, O
Reed F. Blair & Co., Pittsburg, Pa.
Forster, Waterbury & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Washington Coal and Coke Co., Pittsburg, Pa.
Pickands, Mather & Co., Cleveland, O.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Webster Camp & Lane Machine Co., Akron, O.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSED AIR SHOP TOOLS—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Q & C Co., Chicago, Ill.
American Pneumatic Tool Co., New York City.
Manning, Maxwell & Moore, New York City.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

CONTRACTORS FOR CLEANING BOILERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

CONVEYORS—
Jeffrey Mfg. Co., Columbus, O.
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.

CORE OVENS—
Millett Core Oven Co., Brightwood, Mass.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.

CRANES—
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co. Marion, O.
Reading Crane & Hoist Works, Reading, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.

The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B.. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill,

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt.Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas. Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H.Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Bræburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.

FOUNDRY EQUIPMENT.
Miller & Hays, Akron, O.
Tabor Mfg. Co., Elizabeth, N. J.
Millett Core Oven Co., Brightwood, Mass.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Miller & Hays, Akron, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago. Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HOISTS—
Reading Crane & Hoist Works, Reading, Pa.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

HOTELS—
United States Hotel Co., Cleveland, O.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield, Mass.
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.
Skinner Chuck Co., New Britain, Conn.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.
Forster, Waterbury &, Co., Chicago, Ill.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co , Cleveland, O.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis,
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.

PIG IRON—
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.

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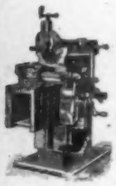

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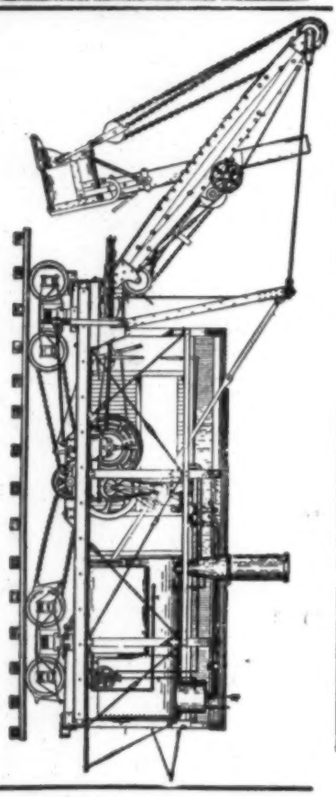

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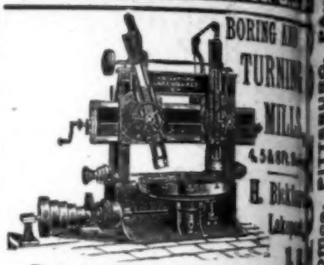

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